Intellectual Output 1

I. Needs analysis

II. Pedagogical framework

Title of document:	Intellectual Output 1
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Introduction

The outbreak of the coronavirus pandemic has caused profound disruption to educational systems as governments across the globe have temporarily suspended educational institutions to contain its spread. Face-to-face classes have been cancelled and shifted to online ones bringing about the rise of online learning that has allowed learners to maintain contact with the teaching and the learning process. The disruption of in-school teaching in European countries from the onset of the COVID-19 pandemic and the sudden transition from face-to-face to online learning has posed, however, numerous problems for students, teachers, administrators, and education leaders, thus revealing the distance learning challenges while capturing a full range of possibilities at hand. The crucial role of school communities as social cells has also emerged cultivating a sense of belonging and safety, a place to develop relationships and a source of support from teachers and peers (European Commission, 2020a).

The pandemic crisis has had a significant impact on the regular delivery of face-to-face teaching and training and "*has created the largest disruption of education systems in history. It has affected 1.6 billion learners in more than 190 countries and all continents. To fight the spread of the virus, schools, colleges and universities have been shut down in the vast majority of EU countries. With few exceptions, courses that had started as face-to-face in classroom environments have been moved online*" (CONNECT proposal, p. 1). The development of distance learning, however, was a wonderful opportunity to enrich teaching practices and to positively embrace a paradigm shift that has been long happening gradually. During the lockdown period more than ever, access to education has proved to be essential to ensuring a swift recovery while promoting equal opportunities among people of all backgrounds. Education researchers, practitioners and policy makers have, thus, been exploring how to support teachers and schools to be innovative in terms of their own organisation as well as pedagogical methods for the benefit of all learners.

Many Member States have experienced shortcomings in their system with a widespread lack of readiness and available resources for the shift to a different approach to teaching and learning, which highlighted and aggravated existing inequalities, gaps, and needs (European Commission, 2020b). Schools have hitherto demonstrated a great capacity to innovate and adopt new approaches but also significant shortfalls from a lack of readiness to take advantage of different learning environments and tools. It should be stressed, nonetheless, that striving towards a vision of a better-quality and inclusive education is by no means limited to the COVID-19 context, notwithstanding the ongoing encountered challenges still exist.

According to the European Commission recommendations about partnerships in the field of school education for 'Digital Education Readiness', it is stated that "*these projects aim at equipping education and training systems to face the challenges presented by the recent sudden shift to online and distance learning, including supporting teachers to develop digital competences and safeguarding the inclusive nature of learning opportunities. The current COVID-19 crisis has greatly accelerated the need for modernisation and digital transformation of education and training systems across Europe*" (European Commission, 2020c, p. 3). Therefore, the partnerships promote networking of institutions across the EU, sharing of resources and expertise, and collaboration with digital technology providers and experts in educational technologies and relevant pedagogical practices, aiming at developing tailor-made solutions adapted to local challenges and realities.

In order to promote quality and inclusive education and meet challenges of improving students' capacity, a blended learning approach requires a coherent approach by the schools as part of a culture of continuous improvement (European Commission, 2021). Within this context, the current European Project Erasmus+ KA2, entitled: "Upskilling of sChools' teachers to effectively support ONliNE EduCaTion", [Grant Agreement: 2020-1-EL01- KA226-SCH-094578], with the acronym "CONNECT" - coordinated by the Regional Directorate of Primary and Secondary Education of Attica, in collaboration with the Institute for Educational Technology (CNR-ITD) of Italy, the Computer Technology Institute and Press "Diophantus" and the University of Cyprus (UCY), addresses the contemporary challenges of the transition from face-to-face to online training, as well as the lack of teachers' digital skills.

With students and teachers as the main beneficiaries (CONNECT proposal, p. 1), the project aims to promote digital education in Mathematics, Physics and Foreign Languages (English and French) in lower secondary education as well as to enhance the professional skills of teachers in digital technology. The project is based on three principles: (a) distance education adapted to secondary education, (b) blended learning and (c) the inverted learning with emphasis on hybrid model; the change of roles and identities of teachers, students and parents is crucial in the context of distance learning.

The main intellectual outputs of the CONNECT project include:

- IO1: a pedagogical framework underpinning the online delivery of courses in secondary schools in addition to the in-class activities (blended learning)

- IO2: at least 27 educational scenarios will be developed for the subject-specific teaching of Language (9 scenarios), Physics (9 scenarios) and Mathematics (9 scenarios) according to the blended learning model

- IO3: a MOOC aiming to training secondary school teachers on the educational material ICT-related skills to foster inclusive online teaching and learning

- IO4: a teacher's guide to support teachers to efficiently use CONNECT approach for the online delivery of courses

- IO5: an exploitation plan with best practises and recommendations for further implementation at school level

This first Output comprises of two parts:

a. the first part is about the research findings regarding the three countries, based on questionnaires responded by 119 practicing teachers of different specialties in lower secondary schools, focus groups' discussions involving teachers, students and parents, as well as structured interviews with high school principals
a) The second part highlights the distance learning principles and the methodological approaches relevant to the pedagogical use of digital tools in school practice and teacher training.

The first Output will be the theoretical framework for the second Output which will deal with the development of educational scenarios in the school subjects of Foreign Language, Mathematics and Physics.

1. Results on distance education, during lockdown

Introduction

A. <u>Aim and scope of the present study</u>

This study focuses on teachers' perceptions about the challenges faced as well as the considerable changes that distance education made in their methodological approaches and other teaching practices followed in every day practice. Additionally, the obstacles and challenges they faced as well as whether they observed any benefits in this period will be addressed. Also, the important issue is whether some of these changes can be considered to contribute to their professional development which tend to be constantly used in the post lockdown era.

B. <u>Methodology and design</u>

The perceptions of teachers, Principals and Deputy Principals were explored using an online questionnaire (Appendix I) and a number of semi-structured interviews (Appendix II) were conducted. The research was carried out during 2019-20 in three countries, namely Cyprus, Greece and Italy.

B.1 <u>Participants</u>

A total of one hundred and nineteen (119) teachers, Principals and Deputy Principals answered the questionnaire whereas ten (10) semi-constructed interviews were conducted by Principals. In particular,

a)   Twenty seven (27) answered questionnaires were returned and three (3) interviews were conducted in Cyprus.

b)   Fifty one (51) answered questionnaires were returned and four (4) interviews were conducted in Greece.

c)   Forty one (41) answered questionnaires were returned and three (3) interviews were conducted in Italy.

B.2 <u>Analysis of the data</u>

The quantitative analysis of the data was made using descriptive statistics, analysing and comparing the participants' answers in the various items of the questionnaire as well as the interviews conducted both per country and all considered together at the end.

B.3 <u>Findings and interpretation</u>

The findings and interpretations of the research questions are presented as follows:

a) Firstly, for each country separately on the grounds that the three educational systems have significant differences in their structure, operation and subsequently in teachers' perceptions. Thus, the interpretation of what teachers of each country report as important might have a straightforward usefulness for the educational system of the specific country allowing to be realistic.

b) Secondly, for the total number of participants in two categories in order to compare critical issues such as digital devices usage and applications, teaching practices, obstacles, challenges and benefits among the countries in addition to observing and pinpointing emerging common trends and needs that are characteristic of these three countries in Southeastern Europe.

1.1. Research findings for Cyprus

The findings of the survey are presented in sections 1.1.1 to 1.1.6 whereas the conclusions in section 1..7.

1.1.1. Demographic outlook

The sample consisted of twenty seven (27) participants. Twenty five (25) were teachers and two (2) were either Principals or deputy Principals. Respectively, twenty two (22) were women and five (5) men.

The teaching experience and age characteristics of the participants are shown in Tables 1.1 and 1.2 below.

Table 1.1. Years of Teaching Experience

Years of Teaching Experience	Frequency	Percentage %
< 5 years	4	14,8
6-10 years	6	22,2
11-20 years	15	55,6
21-30 years	1	3,7
>31 years	1	3,7

Table 1.2. Age of participants

Age of participants	Frequency	Percentage %
< 31 years old	3	11,1
31-40 years old	16	59,3
41-50 years old	6	22,2
51-60 years old	1	3,7
> 61 years old	1	3,7

Tables 1.1 and 1.2 indicate that the majority of the participants had a teaching experience of 6 - 20 years (77.8%). Accordingly, the majority of participants are between the ages of 31 and 50 years old (81.5%). Obviously, most of the participants are from experienced to quite experienced teachers. Ten (10) of them work in Primary Education (37%) and seventeen (17) in Secondary Education (63%).

Secondary teachers are mostly language teachers, as shown in Table 1.3.

Table 1.3. The subject specialism of participants

Secondary education	Frequency	Percentage %
Greek Language	7	41,2
Foreign Language (English)	4	23,5
Mathematics	2	11,8
Informatics	3	17,6
Other	1	5,9

1.1.2. General information about the lockdown period

Tables 1.4-1.6 and Graph 1.1 present findings regarding how the lockdown period was experienced by teachers.

Table 1.4. Location of spending most time during the lockdown period

Location	Frequency
Home	25
Partly at home	1
Out of home	1

Table 1.5. Mode of work during the lockdown period

Mode of work	Frequency
Teleworking full-time	11
Teleworking part-time	15
No teleworking	1

Apparently, the teachers spent most of their time at home. Also, almost half of them were teleworking full-time while the other half were teleworking part-time. All of them were using their own digital devices.

Table 1.6. Emotions experienced during the lockdown period

Happy		Secured		Disoriented		Angry		Anxious	
Not at all	16	Not at all	10	Not at all	6	Not at all	8	Not at all	2
A little	9	A little	10	A little	11	A little	14	A little	11
Somewhat	1	Somewhat	5	Somewhat	7	Somewhat	5	Somewhat	7
A lot	1	A lot	2	A lot	3	A lot	0	A lot	7

Graph 1.1. Emotions experienced during the lockdown period
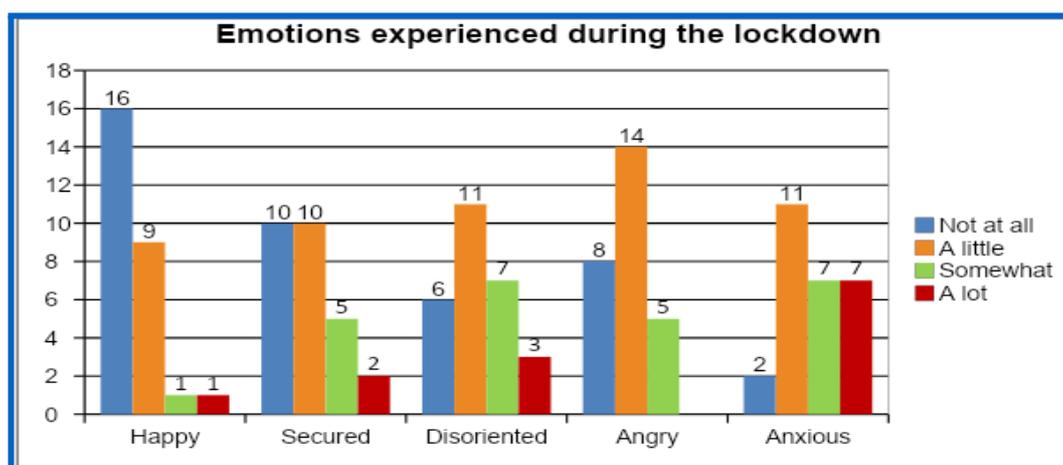
The emotions experienced by teachers during the lockdown period were unhappiness (59.3%), moderate or strong insecurity (74.1%) and anxiety (51,9%). A few of them felt moderate or strong disorientation (37,0%) and anger (18.5%).

1.1.3. Digital devices and applications used in distance education

Findings for the usage of digital devices and digital applications before, during and after the lockdown period are shown in Tables 1.7-1.9 as well as in Graphs 1.2 – 1.4.

Table 1.7. Digital devices usage before, during and after the lockdown

	Before	During	After
Desktop	9	10	11
Laptop	22	19	21
Tablet	11	11	12
Smartphone	21	17	18

Graph 1.2. Digital devices usage before, during and after the lockdown
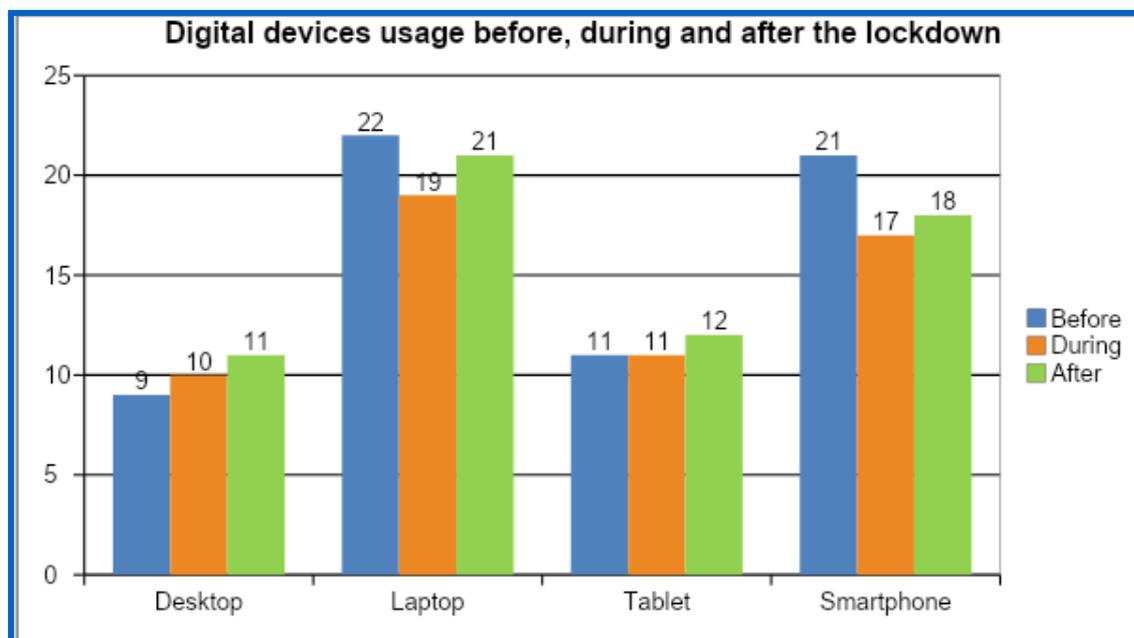
Regarding the frequency of digital devices usage before and after the lockdown period, no significant changes are observed in their usage.

Table 1.8. Digital applications usage for distance education before and after the lockdown

	Often and always Before	Often and always After
e-mail	22	24
sms	19	20
Social networks	12	16
Digital platforms approved by the Ministry of Education (e-class, e-me, etc.)	7	18
LMS (Moodle, Edmondo etc.)	7	20
Online Teleconference Systems (Zoom, Webex, Teams etc.)	8	20
Digital textbooks approved by the Ministry of Education	9	15
Other digital textbooks	8	14

Video platforms (YouTube, Vimeo, etc.)	17	20
Websites, Tools, Applications, Repositories etc. approved by the Ministry of Education	14	15
Other Websites, Tools, Applications, Repositories etc.	6	12
Personal Website or Blog	7	9

Graph 1.3. Digital applications usage for distance education before and after the lockdown
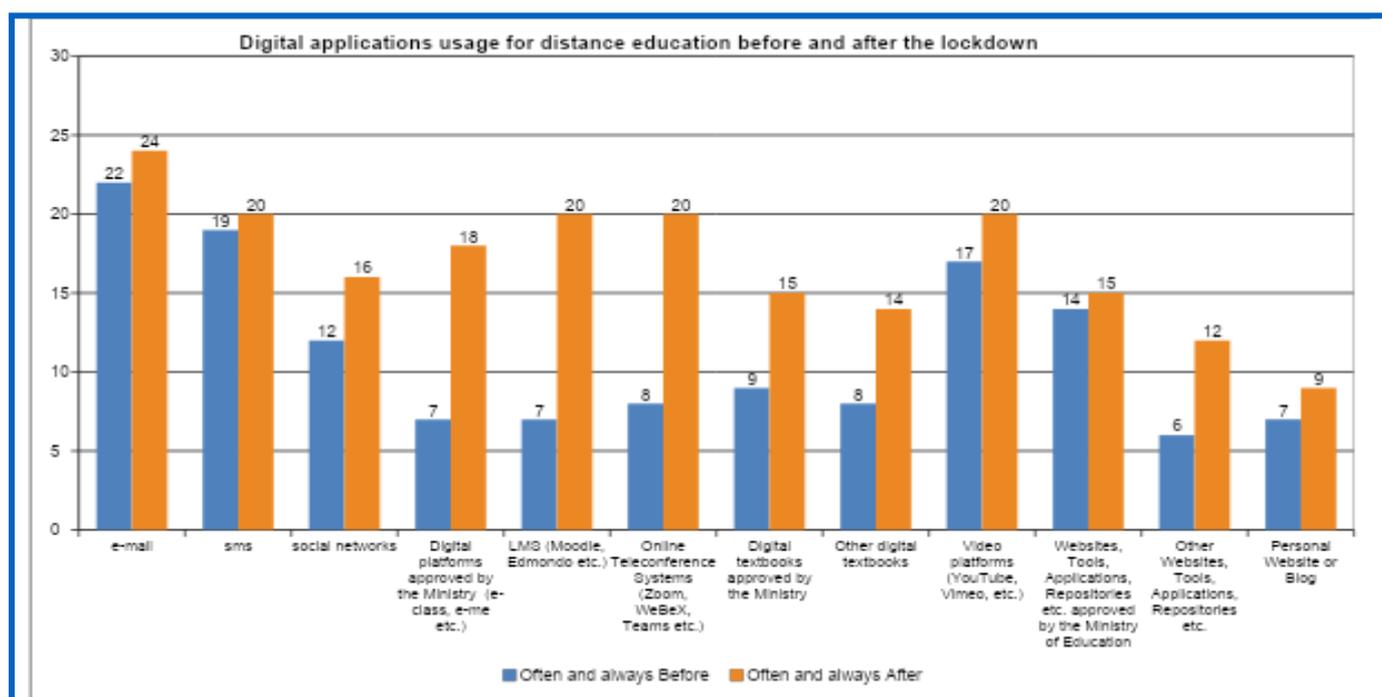
On the contrary, it is clear that after the lockdown the usage of all digital applications is significantly enhanced. In particular, it is observed that digital application usage has more than doubled for the following applications:

a) Digital platforms approved by the Ministry of Education (e-class, e-me, etc.).

b) Learning Management Systems (Edmondo, Moodle etc.).

c) Online teleconference systems (Zoom, Webex, Teams etc.

We also have a doubling or almost doubling in the usage of the following applications

d) Other Websites, Tools, Applications, Repositories

e) Digital textbooks either approved by the Ministry of Education or not.

1.1.4. The emergence of innovative teaching practices

Comparative data in teaching practices and methodologies before and after the lockdown period are presented in Tables 1.9-1.11 and Charts 1.4-1.7.

Table 1.9. Teacher practices before and after the lockdown period

	often and always Before	often and always After
Digital Homework	18	20
Digital communication with students (support messages/comments, feedback etc.)	16	20
Digital sharing of teaching material and resources	13	20
Digital sharing of lessons content with colleagues	8	16
Teleconferences with Colleagues	7	11
Teleconferences with Stakeholders	6	9

Graph 1.4. Teacher practices before and after the lockdown
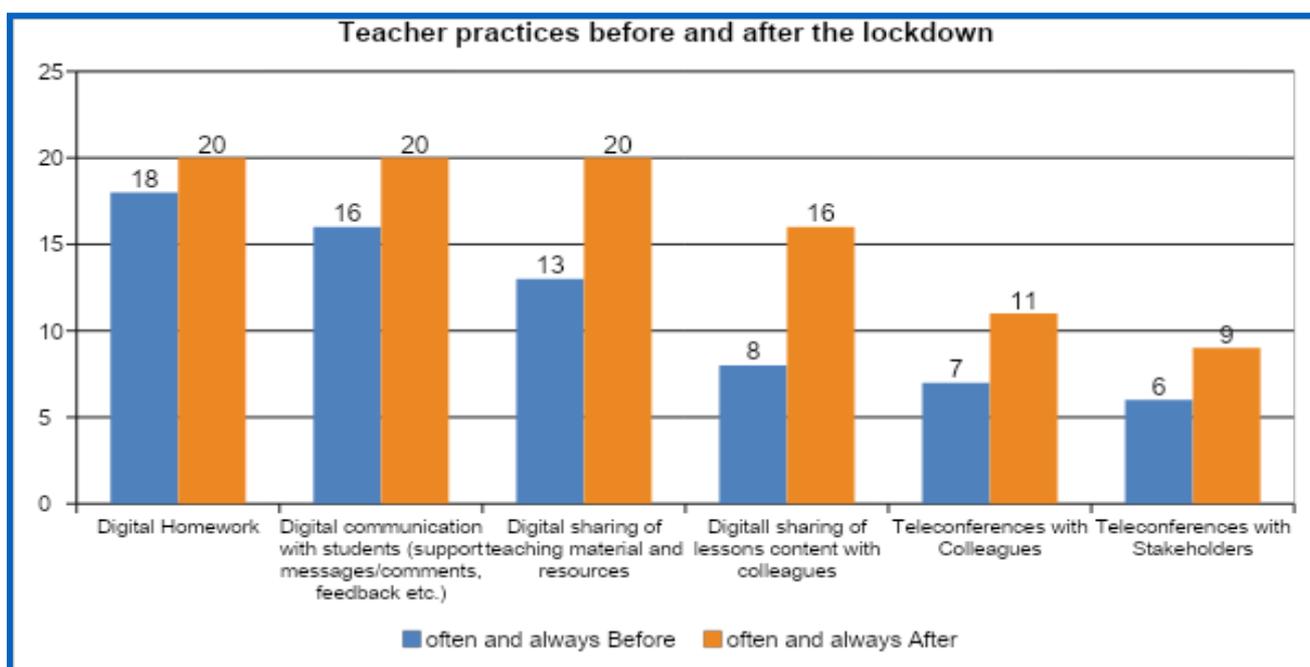
There is a clear increase in the usage of all teacher practices examined. Particularly positive is the large increase of practices such as sharing of teaching materials, resources and lesson plans among colleagues. Also, there is an increase in the usage of video conferencing platforms, for communicating with colleagues, parents and guardians.

Table 1.10. Methodological approaches usage before, during and after the lockdown

	Collaborative Learning practices	Flipped Classroom	Blended Learning	Differentiated approach	Interdisciplinary approach (STEAM, CLIL, etc)	Project-based Learning
Before	24	3	14	16	10	13
During	21	6	20	17	11	15
After	25	5	21	18	15	11

Graph 1.5. Methodological approaches usage before, during and after the lockdown
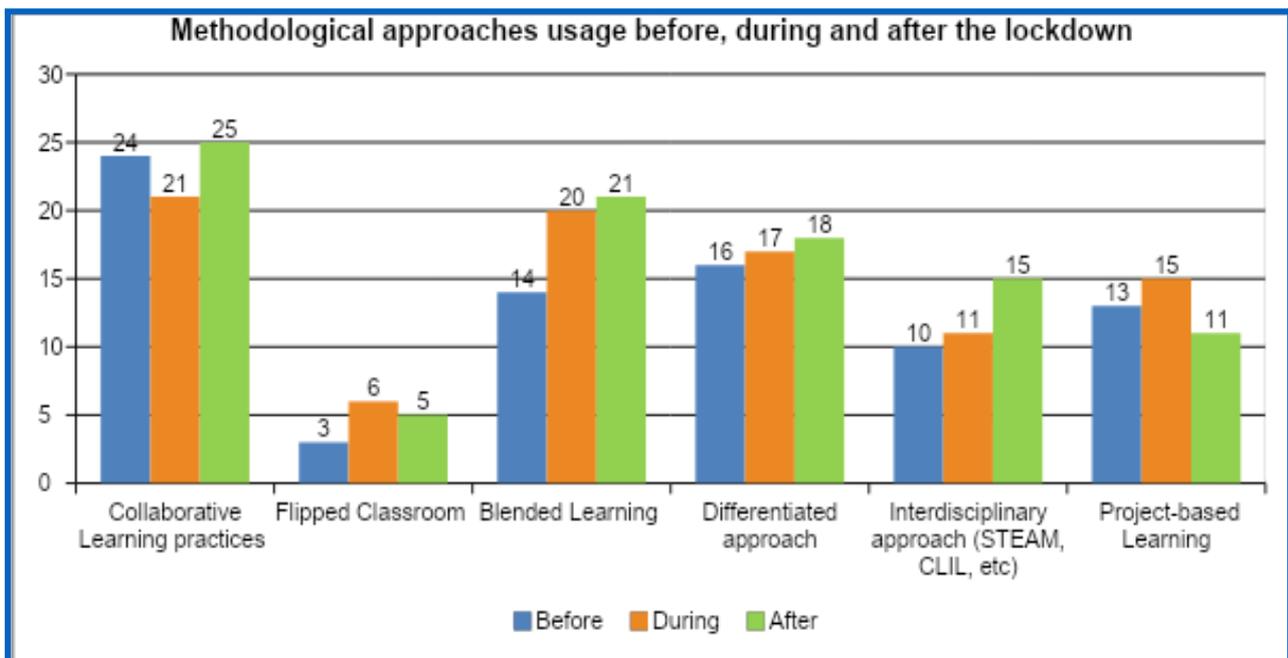
In relation to the methodological approaches, the following are observed:

a) Before the lockdown, more than 50% of the teachers used Collaborative, Differentiated, Blended and Project-based Learning approaches. On the other hand, few teachers only used the Flipped Classroom approach.

b) During the lockdown period, the Collaborative approach declined slightly, while the Blended approach increased considerably. An increment to a much lesser extent is observed for the Flipped Classroom approach and Project-based Learning.

c) After the lockdown the use of Blended approach increased a little more while Flipped Classroom and Project-based Learning decreased. Interdisciplinary approach increased considerably and Collaborative approach is followed once again dynamically.

Table 1.11. Remote collaboration and views exchange during the lockdown

Students	Colleagues from my school	Colleagues from other schools	Principals, deputy-Principals or educational advisors of my school	Principals, deputy-Principals or educational advisors of other schools	Academic advisors, school inspectors etc.	External partners
14	25	11	11	3	5	5

Graph 1.6. Remote collaboration and views exchange during the lockdown
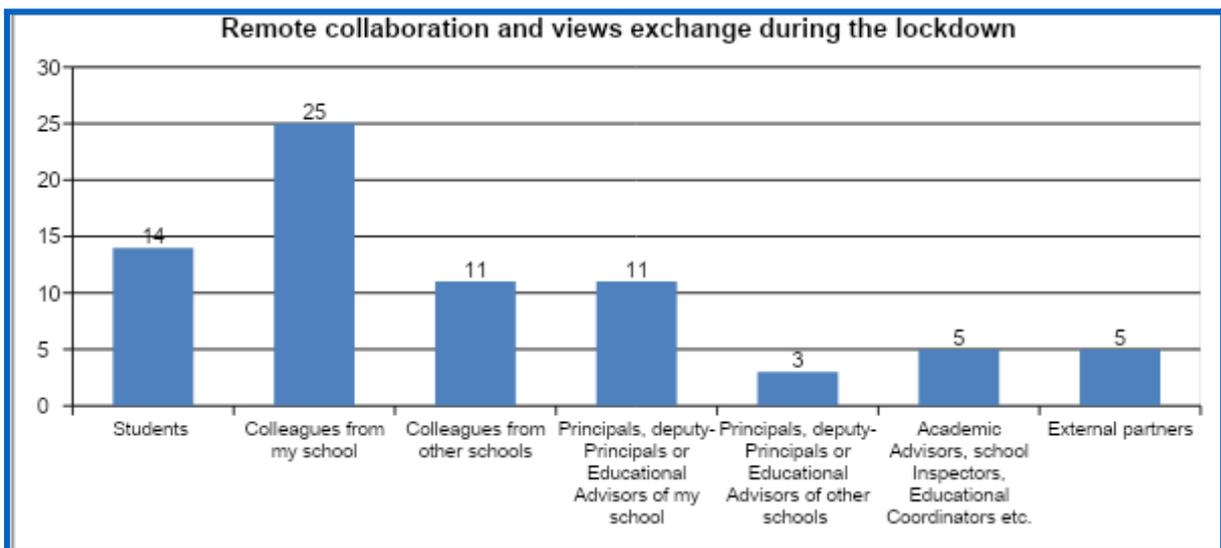
Relevant findings in Table 1.9 about enhanced peer-to-peer cooperation between colleagues are confirmed as well in Graph 1.6. During the pandemic, a very high percentage (92,6%) collaborated and exchanged views with colleagues from their school in order to cope with the new context for distance education teaching for which they had no relevant experience or training before.

Moreover, a significant number of teachers collaborated and exchanged views with:
- Their students (51.9%).
- Principals, Deputy-Principals or educational advisors of their school (40,7%).
- Colleagues from other schools (40,7%).

1.1.5. Problems, difficulties and benefits arising from the distance education period

Tables 1.12-1.14 and Graphs 1.7-1.9 present teachers' views on obstacles, difficulties and benefits associated with the distance learning period.

Table 1.12. Main obstacles to ensure educational continuity between school and family during the lockdown

Families' lack of digital devices	Risk of increasing digital divide and inequalities	Cultural or social distance between students and school	Difficulties in designing effective distance lessons	Difficulties in cooperating with families	Increase of students' autonomy doing tasks and activities	Additional difficulties in managing teaching and learning in distance education	School is seen as the only place to learn	Education in general is not seen as sufficiently open and accessible
13	2	16	15	18	5	18	7	4

Graph 1.7. Main obstacles to ensure educational continuity between school and family during the lockdown
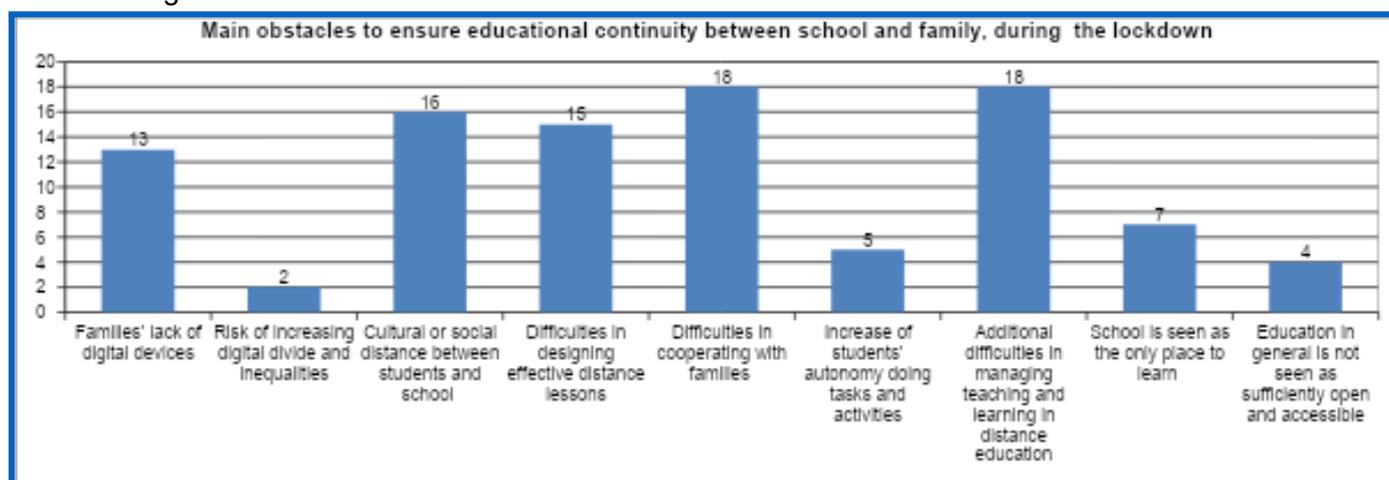
The main existing obstacles and concerns expressed by teachers regarding distance education are:

a) Additional difficulties in managing teaching and learning in distance education (66.7%).

b) Difficulties in cooperating with families (66.7%).

c) Cultural or social distance between students and school (66.7%).

d) Difficulties in designing effective distance lessons (59.3%).

e) Families' lack of digital devices (48.1%).

Table 1.13. Main challenges of distance education

The model of teaching approaches	Assessment reliability	Following curricula	Managing teaching/ learning time	Inequalities among students (e.g. internet access, use of tools, etc.)	Parents' role	Collaboration with colleagues	Professional inequalities (e.g. internet access, use of tools, etc.)	Delay implementing Interdisciplinary Projects	The weakening of the education system	Other
10	8	13	7	10	9	11	5	12	7	4

Graph 1.8. Main challenges of distance education
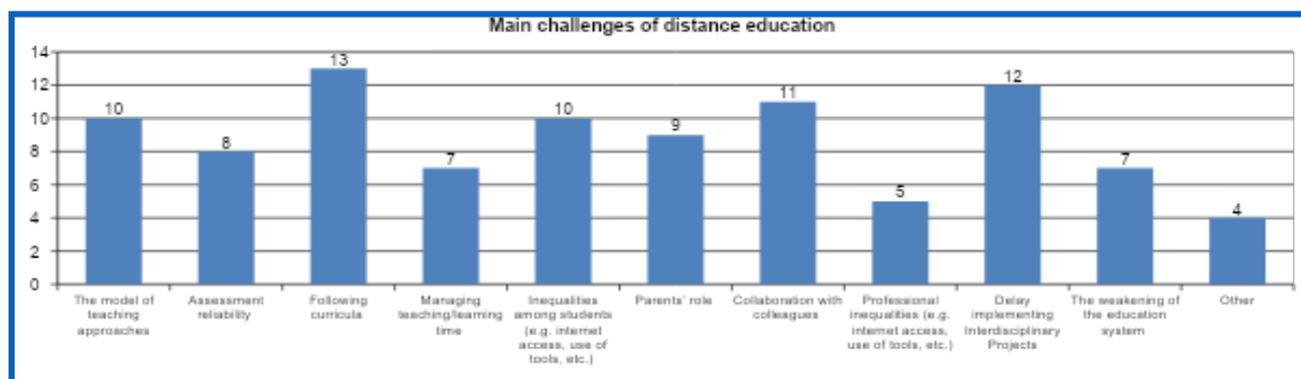
Other: *"Student motivation for team work" (3/27) and "Teacher - student interaction" (1/27)*

Teachers point out as the most important challenges of distance education the following:

a) Following curricula (48.1%).

b) Delay implementing Interdisciplinary Projects (44.4%).

c) Collaboration with colleagues (40.7%).

d) Inequalities among students (e.g. internet access, use of tools, etc.) (37.0%).

e) The model of teaching approaches (37.0%).

Table 1.14. Main advantages of distance education

Having more flexibility in the management of resources and activities	Maintaining socio-psychological bonds with students remotely	Supporting the learning process for each student	Reinforcing student autonomy	Reinforcing school-family relation	Developing 21st century skills
14	10	9	17	9	17

Graph 1.9. Main advantages of distance education

Main advantages of distance education
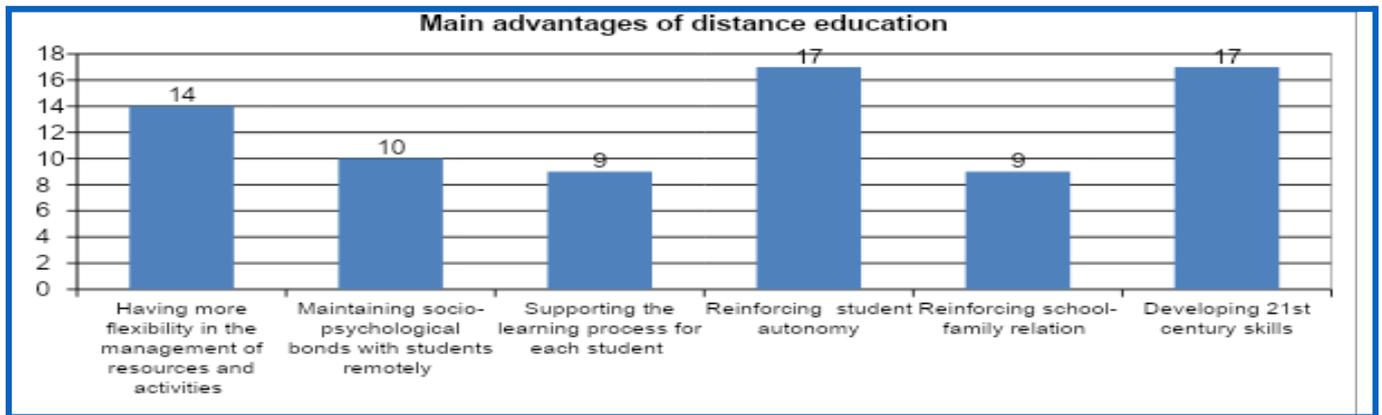
The main benefits of distance education according to the participants are:

a) Reinforcing student autonomy (63.0%).

b) Developing 21st century skills (63.0%).

c) Having more flexibility in the management of resources and activities (51.9%).

1.1.6. Principals' perceptions about the lockdown period

The three interviews conducted provided either unanimous or clearly converging views in the following:

- The lockdown period changed the way Principals organized personal work and communicated with teachers.
- There were difficulties in the use of technological equipment by some students.
- Home context for students' learning achievements was not the best possible.
- A number of teachers did not have the technical skills required to provide online lessons. Therefore, they had to be supported with appropriate courses and learning communities. In general, teachers in need of acquiring such skills and expertise were supported mainly by teachers of Informatics.
- Communication with parents and guardians was achieved to a satisfactory extent through the use of teleconferencing (MS Teams) and, secondarily, over the telephone.
- Despite the fact that the Ministry of Education provided public schools with digital tools and resources, it was not possible for a number of schools to meet this goal.
- On the other hand, private schools did not receive any support from the Ministry of Education.
- The collaborative MS Teams platform was widely used with positive results.
- Principals consider that finally teachers will return to face to face teaching practices.

1.1.7. Conclusions on Cyprus

Distance education in Cyprus was implemented with the use of digital tools and was, mostly, organised by teachers at home, in aggravated conditions with emotions of unhappiness, insecurity and anxiety.

There are no noteworthy changes in digital devices usage before, during and after the lockdown. On the other hand, there is a clear increase in the use of all digital applications in the teaching-learning process and particularly of:

• Digital environments approved by the Ministry of Education (e-class, e-me etc.).

• Learning Management Systems (Edmondo, Moodle etc.).

• Online teleconference systems (Zoom, Webex, Teams etc.).

• Other Websites, Tools, Applications, Repositories.

• Digital textbooks, either approved by the Ministry or not.

The teaching approach that comparatively gains more ground is Blended learning increasing from 52% to 75%. A noteworthy increase soaring to 55,6% from 37,0% indicates a high percentage of the interdisciplinary approach usage and the flipped classroom approach usage increased from 11% to 19%.

The collaborative approach remains a major methodology followed by the Cypriot teachers as it is used by 93% of participants after the lockdown (89% before and 77,7% during the lockdown). Also, the differentiated approach is a common methodology in Cyprus as it is used by 66,7% of the participants.

These findings corroborate the main benefit of teachers' professional development in terms of enhancing their digital skills as well as the expansion of their teaching repertoire.

The main obstacles and concerns expressed by many teachers regarding distance education are as follows:

1) It is more difficult to manage and design effective lessons. It is pointed out that the teachers who participated in the research do not report shortcomings in the effectiveness of distance learning, whereas difficulties in this direction are pointed out by the Principals who participated in the research.

2) With reference to cultural or social distance between students and school, teachers seem to believe that existing learning inequalities are widened by distance education.

3) The shortages in technological equipment are also confirmed by the Principals. Principals reports additional problems such as the lack of internet connection. Principals confirm

shortages in technological equipment as well as the additional problem of lack of internet connection. On the other hand, they express a different view on school - families' cooperation, which in their opinion was done smoothly with the use of digital technology and frequent telephone communication.

The challenges of distance education are the need to keep up with curriculum, the range of collaboration with colleagues and the transformation of face-to-face lesson plans to distance education lesson plans. Additionally, the delays in the implementation of interdisciplinary approach and addressing the existing inequalities among students, the main benefits for both students and teachers respectively reported by teachers are:

a) **Students**: Enhancement of autonomous learning and strengthening 21st century skills.

b) **Teachers**: Expanding their flexibility in managing learning resources and activities. Principals have similar views on this issue putting emphasis on the expertise in the MS Teams platform.

In conclusion, distance education had some positive results for the educational system of Cyprus, mainly strengthening teachers' digital skills and enriching teaching repertoire. Nonetheless, teachers and Principals' views do not converge on the effectiveness of distance learning.

An issue to be further examined is the effectiveness of distance education during the lockdown period. This teaching approach is considered having relatively poor academic results in comparison with face-to-face teaching both in primary and secondary education. Thus, there is a high probability that many students were promoted to the next class despite having achieved poor to very poor learning outcomes.

1.2.   Research findings for Greece

The findings of the survey are presented in sections 2.1 to 2.6 whereas the conclusions in section 2.7.

1.2.1. Demographic outlook

Table 2.1 presents the frequency and the percent distribution of teaching experience of the fifty one (51) survey participants who were teachers (41 out of the total 51) while the rest ten (10) of them were either Principals or deputy-Principals. Thirty-five (35) out of the fifty one (51) participants were women while sixteen (16) of them were men respectively.
Table 2.2 shows the age characteristics of the participants.

Table 2.1. Years of Teaching Experience

Years of Teaching Experience	Frequency	Percentage %
< 5 years	6	11,8
6-10 years	0	0
11-20 years	23	45,1
21-30 years	15	29,4
>31 years	7	13,7

Table 2.2. Age of the participants

Age of participants	Frequency	Percentage %
< 30 years old	1	2,0
31-40 years old	4	7,8
41-50 years old	23	45,1
51-60 years old	14	27,5
> 61 years old	9	17,6

Tables 2.1 and 2.2 indicate that the majority of the participants had a teaching experience of 11-30 years (74.5%). Accordingly, the age of the majority of participants (72,6%) ranges from 41 to 60 years old. Obviously, the majority of participants have extensive teaching experience with only very few of the total number of participants having less than five years of teaching experience.

Only 2 of the participants work in Primary Education, while 49 (96.1%) work in Secondary education. Secondary teachers are mostly language teachers (41.2%), with an average number of Mathematics (17,6%) and Science (13.7%) teachers, as shown in Table 3.3.

Table 2.3. The subject specialism of participants

Teacher's Specialty	Frequency	Percentage %
Physics	7	13,7
Maths	9	17,6
Informatics	4	7,8
Greek Language	10	19,6
English-French-German Language	11	21,6

Civic- Economics	2	3,9
Teacher	2	3,9
Other	6	11,8

1.2.2. General information about the lockdown period

Tables 2.4 – 2.6 and Graph 2.1 illustrate findings on how the lockdown period was experienced by Greek teachers.

Table 2.4. Location of spending most time during the lockdown period

Location	Frequency
Home	50
Partly at home	0
Out of home	1

Table 2.5. Mode of work during the lockdown period

Mode of work	Frequency
Teleworking full-time	43
Teleworking part-time	7
No teleworking	1

Apparently, almost all teachers spent most of their time at home. Also, 84,3% of them were teleworking full-time and 13,7% of them were teleworking part-time. The total of participants was using their personal digital equipment.

Table 2.6. Emotions experienced during the lockdown period

Happy		Secured		Disoriented		Angry		Anxious	
Not at all	17	Not at all	5	Not at all	14	Not at all	12	Not at all	8
A little	17	A little	13	A little	21	A little	29	A little	21
Somewhat	17	Somewhat	23	Somewhat	11	Somewhat	7	Somewhat	14
A lot	0	A lot	10	A lot	5	A lot	3	A lot	8

Graph 2.1. Emotions experienced during the lockdown period
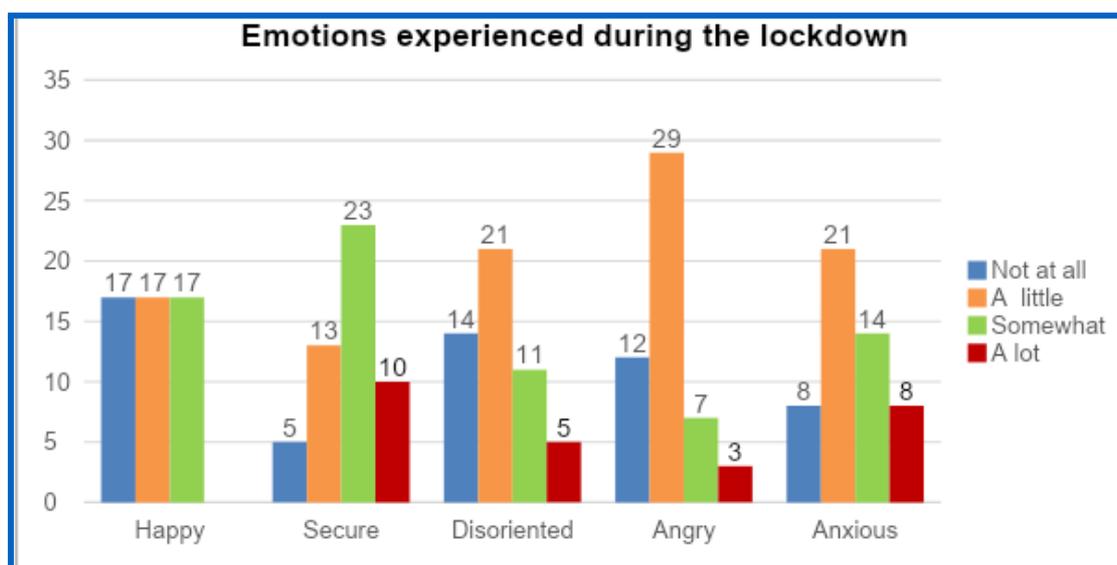
A large part of teachers experienced negative emotions during the lockdown period, such as unhappiness (33.3%), moderate or strong insecurity (35.3%), disorientation (31,4%), and anxiety (43,1%).

1.2.3. Digital devices and applications used in distance education

Tables 2.7- 2.9 and Graphs 2.2 – 2.4 are indicative of digital devices and digital applications usage before, during and after the lockdown period.

Table 2.7. Digital devices usage before, during and after the lockdown

	Before	During	After
Desktop	20	19	20
Laptop	46	45	45
Tablet	18	14	18
Smartphone	36	25	36
Other (Digital stylus)	0	1	0

Graph 2.2. Digital devices usage before, during and after the lockdown
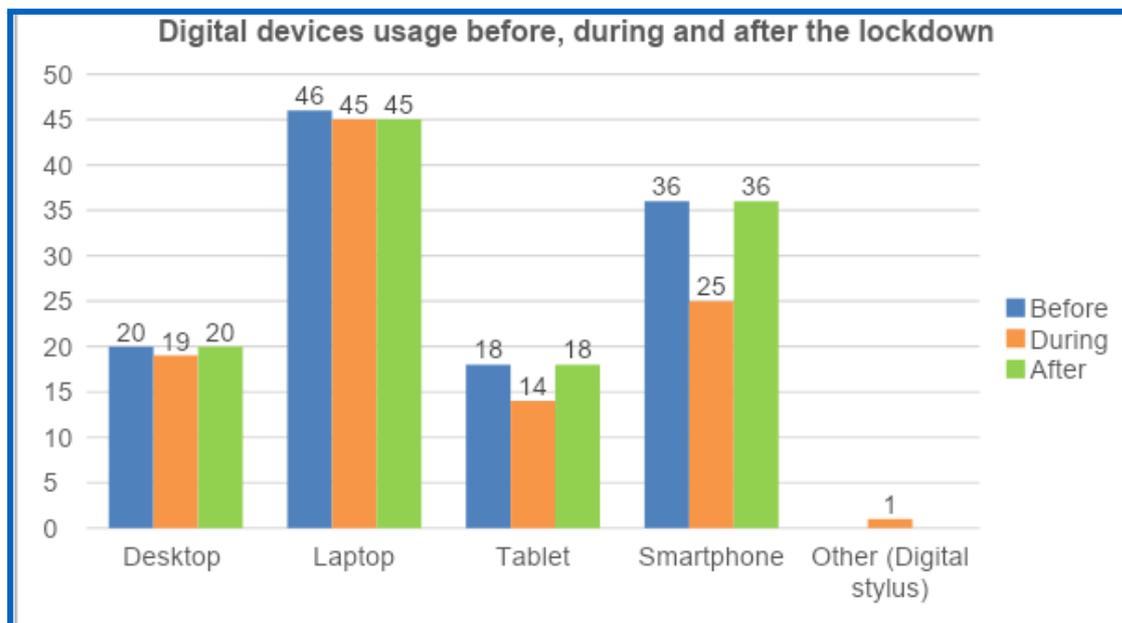
Regarding the frequency of digital devices usage before and after the lockdown period, no significant change in their use is observed.

Table 2.8. Digital applications usage for distance education before and after the lockdown

	Before (often and always)	After
e-mail	36	35
sms	17	8
Social networks	15	5
Digital platforms approved by the Ministry of Education (e-class, e-me, etc.)	20	32
LMS (Moodle, Edmondo etc)	14	19
Online Teleconference Systems (Zoom, Webex, Teams etc)	8	24
Digital textbooks approved by the Ministry of Education	24	21
Other digital textbooks	19	7
Video platforms (YouTube, Vimeo, etc)	30	21

Websites, Tools, Applications, Repositories etc. approved by the Ministry of Education	26	16
Other Websites, Tools, Applications, Repositories etc.	21	16
Personal Website or Blog	6	4

Graph 2.3. Digital applications usage for distance education Before and After the lockdown
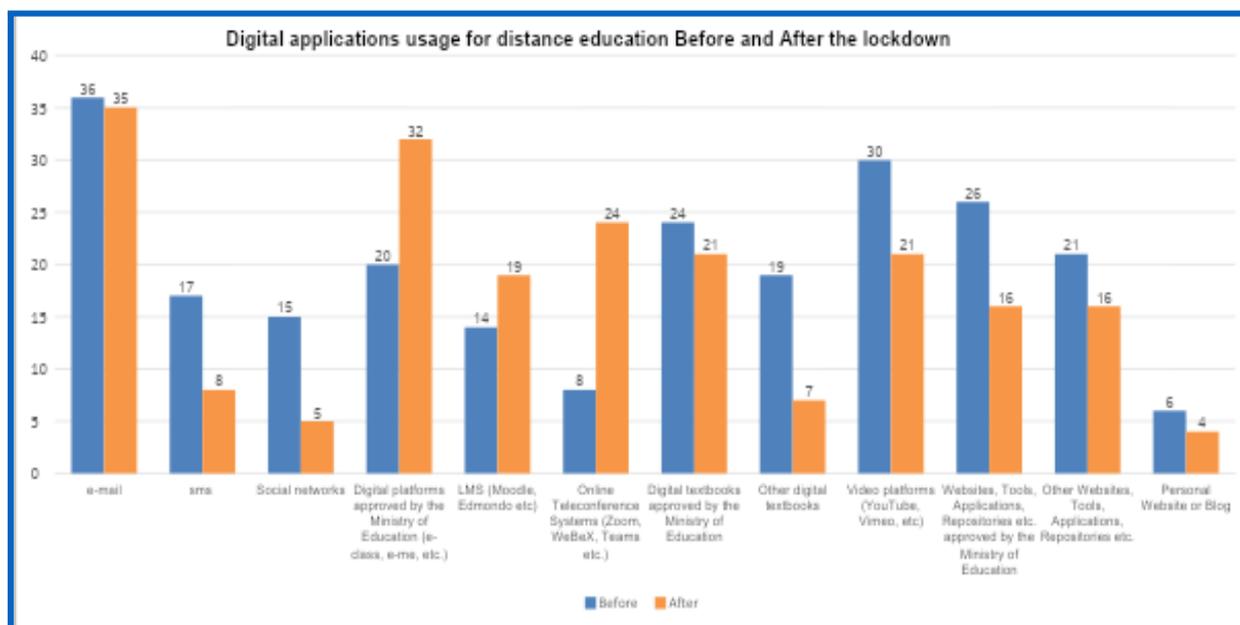
It is clear that after the lockdown the usage of several digital applications is significantly enhanced with a high increase, while there is a fluctuation regarding a number of them compared to the period before the lockdown era. In particular, the findings indicate a high percentage increase for the following applications:

a) Digital platforms approved by the Ministry of Education (e-class, e-me, etc.) which are currently used by the majority of participants increased by 60%.

b) Online teleconference systems (Zoom, Webex, Teams etc.) increased by 200%!

c) Learning Management Systems (Edmondo, Moodle etc.), increaded by 35.7%.

Findings, however, exhibit a very limited usage of the following applications:

a) Social networks decreased by 66.7%.

b) Other digital textbooks decreased by 63.2%.

c) Sms decreased by 52.9%.

A minor decrease is observed in the following:

d) Websites, Tools, Applications, Repositories etc. approved by the Ministry of Education decreased by 38.5%.

e) Video platforms (YouTube, Vimeo, etc) decreased by 30%.

1.2.4. The emergence of innovative teaching practices

Tables 2.9 - 2.11 and Graphs 2.4 - 2.7 put forward comparative data on innovative teaching practices and methodologies usage before and after the lockdown period.

Table 2.9. Teacher practices Before and After the lockdown period

	often and always Before	often and always After
Digital Homework	11	28
Digital Communication with students (support messages/comments, feedback etc.)	12	27
Digital sharing of teaching material and resources	16	32
Digital sharing of lessons content with colleagues	12	21
Teleconferences with Colleagues	8	23
Teleconferences with Stakeholders	2	21

Graph 2.4. Teacher practices usage Before and After the lockdown
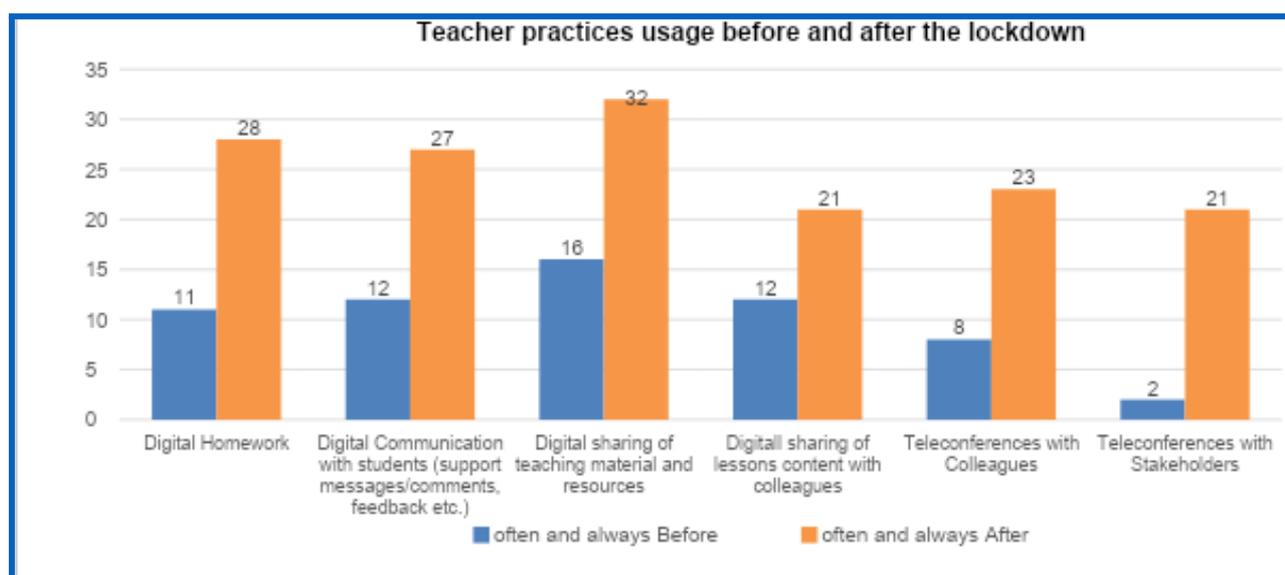
Findings show a striking high percentage increase of all practices under examination.

Digital homework increased by 155%.

Digital Communication with students (support messages/comments, feedback etc.) increased by 125%.

Digital sharing of teaching materials and resources increased by 100%.

Digital sharing of lessons content with colleagues increased by 75%.

Teleconferences with Colleagues increased by 187.5%.

Teleconferences with Stakeholders increased by 950%.

Table 2.10. Methodological approaches usage before, during and after the lockdown

	Collaborative Learning practices	Flipped Classroom	Blended Learning	Differentiate d approach	Interdisciplinary approach (STEAM, CLIL, etc.)	Project-b ased Learning	None of them
Before	36	12	23	20	16	36	3
During	34	20	26	20	16	34	2
After	39	16	27	18	14	33	2

Graph 2.5. Methodological approaches usage before, during and after the lockdown
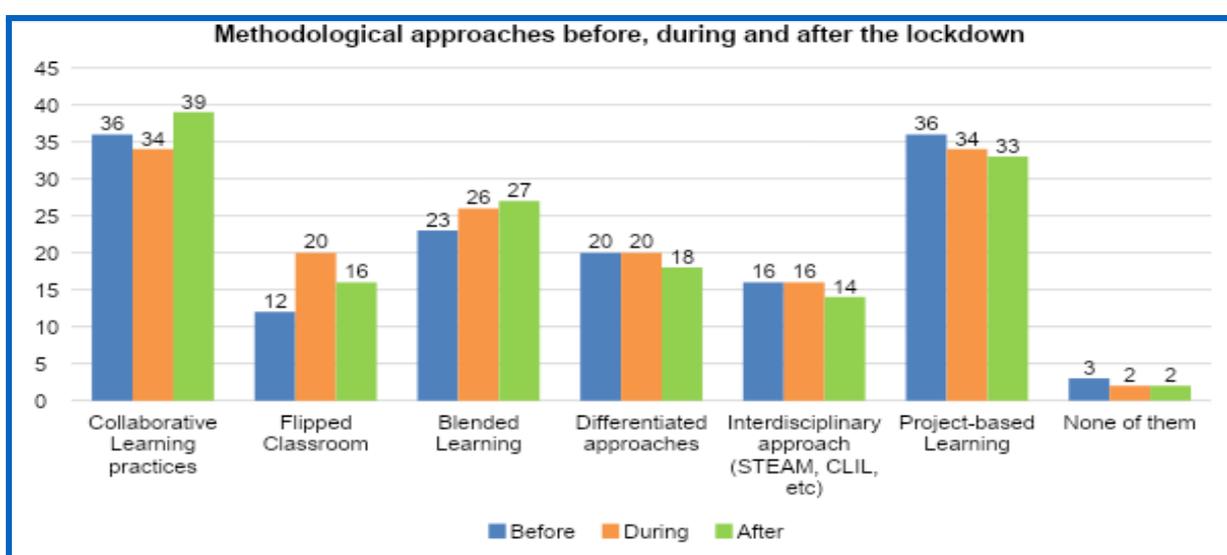
Considering the methodological approaches, the following are observed:

a) Before the lockdown, more than 70% of the teachers use Collaborative Learning and Project-based Learning approach. Blended Learning and Differentiated approach were used by 45,1% and 39,2%, respectively. Interdisciplinary approach and Flipped Classroom was adopted to a much lesser extent.

b) During the lockdown, there is a major increase in the use of Flipped Classroom (66,7%) and a minor increase of Blended Learning (13,0%).

c) After the lockdown, the use of Blended approach increases slightly, while Flipped Classroom approach decreases considerably (20 %). During the whole lockdown period Collaborative Learning practice is the most frequently used method.

Table 2.11. Remote collaboration and views exchange during the lockdown

Students	Colleagues from my school	Colleagues from other schools	Principals, deputy-Principals or Educational Advisors of my school	Principals, deputy-Principals or Educational Advisors of other schools	Academic Advisors, school Inspectors, Educational Coordinators etc	External partners
40	50	30	33	2	13	11

Graph 2.6. Remote collaboration and views exchange during the lockdown
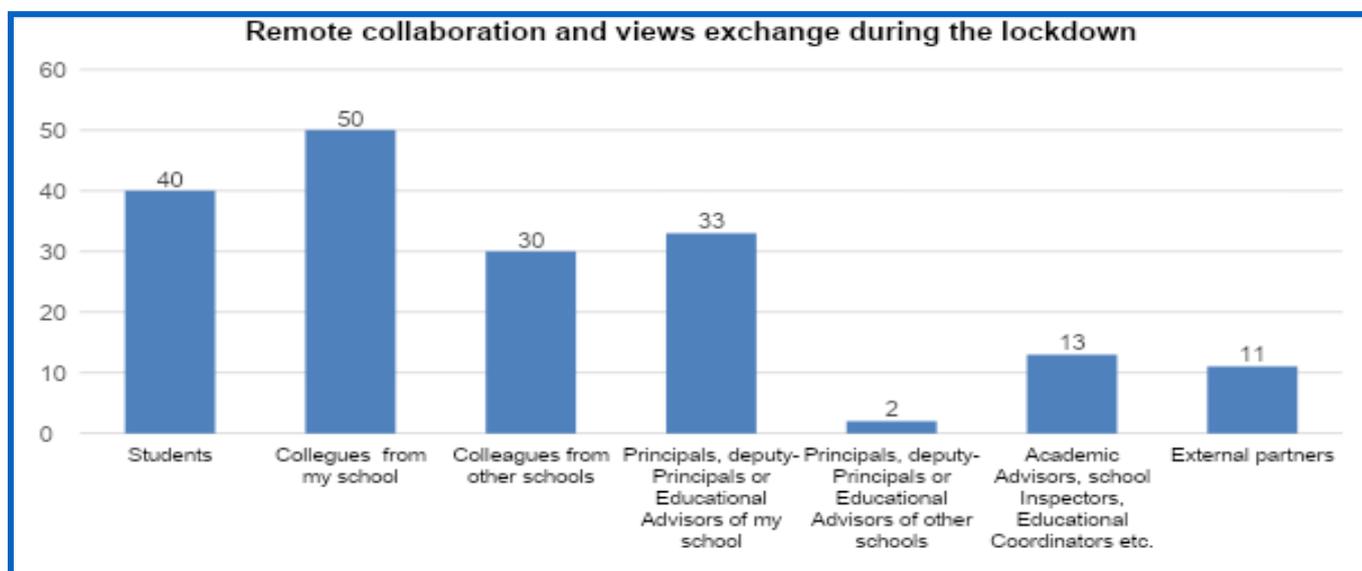
The finding of Table 2.9 about enhanced cooperation between colleagues is also confirmed. During the pandemic, almost all participants (98,0%) confirm a cooperative attitude with colleagues including exchanging of views, aiming at improving lesson planning and effectiveness as well as coping with difficulties arising due to the new context of distance education.

Moreover, a significant number of teachers collaborate and exchange views with:
- Their students (78.4%).
- Principals, deputy-Principals or Educational Advisors of their school (64,7%).
- Colleagues from other schools (58,8%).

1.2.5. Problems, difficulties and benefits arising from the distance education period

The following Tables 2.12-2.14 and Graphs 2.7-2.9 show the range of data on teachers' views regarding obstacles, difficulties and benefits associated with the distance learning period.

Table 2.12. Main obstacles to ensure educational continuity between school and family during the lockdown

Families' lack of digital devices	Risk of increasing digital divide and inequalities	Cultural or social distance between students and school	Difficulties in designing effective distance lessons	Difficulties in cooperating with families	Increase of students' autonomy doing tasks and activities	Additional difficulties in managing teaching and learning in distance education	School is seen as the only place to learn	Education in general is not seen as sufficiently open and accessible	Other
36	20	23	22	15	9	22	11	6	1

Other: The immaturity of students and the lack of responsibility in terms of monitoring and handing in assignments.

Graph 2.7. Main obstacles to ensure educational continuity between school and family during the lockdown
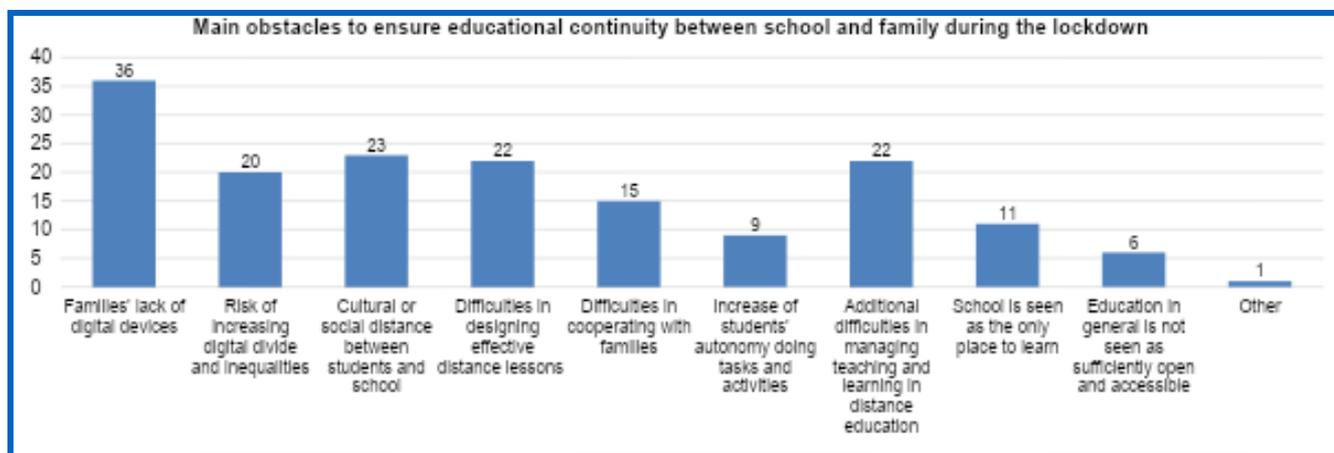
The main obstacles and concerns expressed by teachers regarding distance learning are:
a) Families' lack of digital devices (70.6%).

b) Cultural or social distance between students and school (54.9%).

c) Difficulties in designing effective distance lessons (43.1%).

d) Additional difficulties in managing teaching and learning in distance education (43.1%).

e) Risk of increasing digital divide and inequalities (39.2%).

Table 2.13. Main challenges of distance education

The model of teaching approaches	Assessment reliability	Following curricula	Managing teaching/ learning time	Inequalities among students (e.g. internet access, use of tools, etc.)	Parents' role	Collaboration with colleagues	Professional inequalities (e.g. internet access, use of tools, etc.)	Managing student involvement during distance lesson
28	39	14	24	27	20	12	6	1

Graph 2.8. Main challenges of distance education
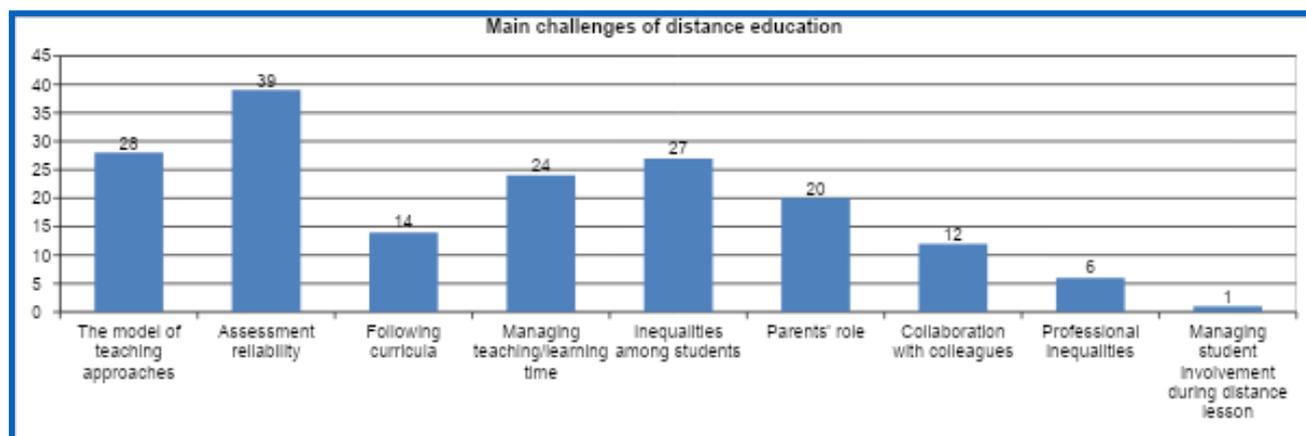
Teachers point out as the most important challenges for distance education the following:

a) Assessment reliability (76.5%).

b) The model of teaching approaches (54,9%).

c) Inequalities among students (e.g. internet access, use of tools, etc.) (52.9%).

d) Managing teaching / learning time (47.1%).

e) Parents' role (39.2%).

Table 2.14. Main advantages of distance education

Having more flexibility in the management of resources and activities	Maintaining socio-psychological bonds with students remotely	Supporting the learning process for each student	Reinforcing student autonomy	Reinforcing school-family relation	Developing 21st century skills
39	31	11	22	5	32

Graph 2.9. Main advantages of distance education
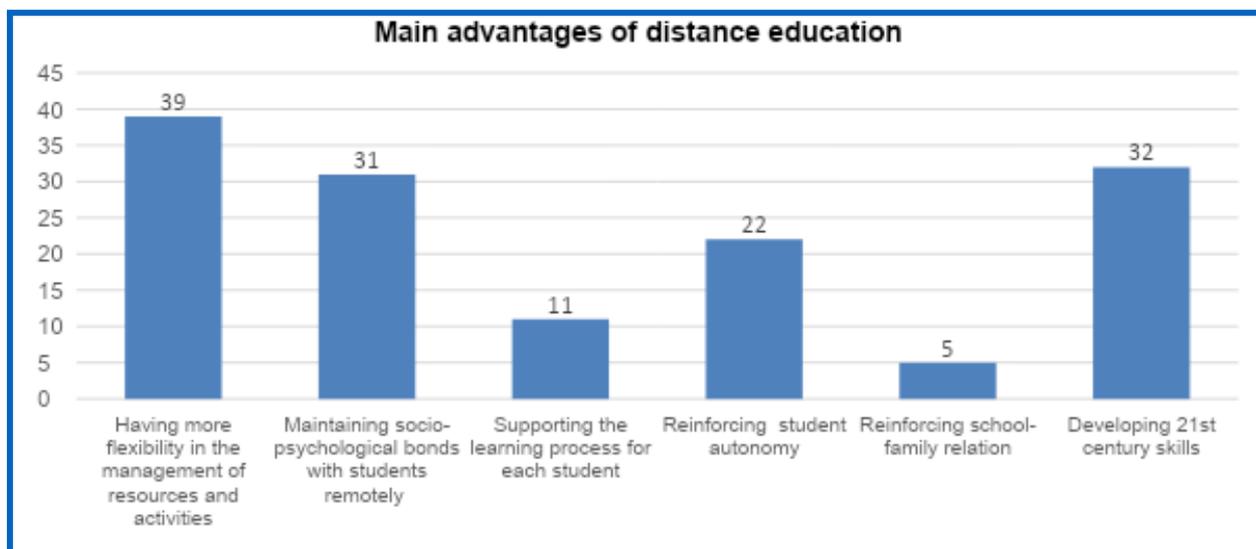
The findings illustrate that the main benefits of distance education according to the participants are:

a) Having more flexibility in the management of resources and activities (76.5%).

b) Developing 21st century skills (62.7%).

c) Maintaining socio-psychological bonds with students remotely (60.8%).

1.2.6. Principals' perceptions about the lockdown period

The four interviews conducted provided either unanimous or clearly converging views as follows:

- The lockdown period changed the way Principals organized personal work and communicated with teachers.
- There were difficulties having internet connection and using technological equipment by some students.
- Two Principals pointed out that students' had their cameras turned off during the teaching and learning process in distance education and this allowed a number of them not to participate sufficiently in the learning process.
- Some teachers did not have the desired technical skills or expertise to provide effective online lessons. Therefore, they had to be supported with appropriate courses either by teachers of informatics or by the Regional Centers for Educational Planning or the directorate of Education.
- Communication with parents and guardians was achieved to an extent via teleconferencing.
- An important benefit of this period is the growth of teachers' digital skills, a fact which can mainly contribute to the enrichment of teachers' practices in face-to-face teaching.

1.2.7. Conclusions on Greece

Distance education in Greece was implemented via tele-conferences organised by teachers mostly from their home, whereupon the one third of them was in an unsteady emotional state feeling unhappy, insecure and anxious.

No significant changes were reported on digital devices usage before, during or after the lockdown period.

In particular, usage of the following digital applications was considerably increased:

- Digital environments approved by the Ministry of Education (e-class, e-me etc.).
- Online Teleconference Systems (Zoom, Webex, Microsoft Teams etc.).
- Learning Management Systems (Edmondo, Moodle etc.).

However, a percent decrease is reported for the following applications usage after the lockdown period as follows:

- Social networks.
- Other digital textbooks.
- sms.
- Websites, Tools, Applications etc. approved by the Ministry of Education.
- Video platforms (YouTube, Vimeo, etc.).

In the post-lockdown period, a large repertoire of classroom teaching practices is identified in the research findings.

The lockdown period seems to have a positive effect in the following three factors:

a) Strengthening of collaborative practices among teachers, sharing teaching materials, lesson plans and started communicating via teleconferencing.

b) Increased digital communication with students, who were not only assigned extra homework but were provided with immediate feedback.

c) Increased digital communication with parents and guardians via teleconferences.

Blended learning is steadily gaining ground, finally soaring to 52.9% after the lockdown gradually increasing from 45.1% before the lockdown to 51.0% during the lockdown period. Nonetheless, during the lockdown period collaborative learning sessions did not occur as often as previously.

However, collaborative learning practices soar to a final rise at 76.5% exhibiting a fluctuation from 70.6% to 66.7%.

It is worth mentioning, after all, that the aforementioned teaching and learning practice is considered the most widely used among the suggested practices in the research questionnaire.

The project method is as well widely used, but it has a slight percentage decrease from 70.6% to 66.7% and finally to 64.7%. Differentiated teaching approach is also slightly declining from 39.2% to 39.2% and finally to 35.3%. It is worth mentioning that there is a striking increase in the use of the flipped classroom during the lockdown period as well as its relative decline thereafter (from 23.5% to 39.2% and finally to 31.4%).

Taking into consideration the aforementioned, it becomes obvious that applying distance education especially during the lockdown period did not have a dramatic impact on the methodologies used by the participants.

Undoubtedly, the fact that teachers have developed multi-level collaborations in order to cope with implementing distance education has positive results, a feature which also accentuated in Table 9. Almost all of the participants collaborated with their colleagues at school exchanging views and experiences gained. They also strengthened cooperation with their students, with the school support team as well as with colleagues from other schools. Only a quarter of the participants point out that they collaborated and exchanged views with members of supporting organisation such as Regional Centers for Educational Planning or the Directorate of Education. However, this is not fully in line with the views expressed by Principals in the interviews conducted, who point out the support schools received from these supervising organisations of major importance.

The majority of the study participants consider that the impact of distance education has been limited by:

a) The lack of technological equipment and know-how of students and their families, a fact which is in addition confirmed by school Principals. Principals additionally report the existence of financial difficulties for a number of families to have internet connection.

b) Cultural or social distance between students and school.

c) The management of distance teaching and learning combined with difficulties in the effective planning of online courses. These difficulties are also pointed out by Principals in their interviews.

In addition, two (2) Principals report that a significant obstacle was created by the closed cameras that did not facilitate the active participation of students in the distance learning process, an important factor which is not reported emphatically by teachers.

Assessment reliability, the model of teaching approaches, tackling inequalities among students, managing teaching/learning time and the role of parents were as well mentioned as challenges in distance education.

With reference to teachers the main benefits arising for them is gaining flexibility in managing learning resources and activities which is a common point of view shared by Principals, who identify the skills they have developed in the use of platforms and digital applications as an important asset.

As for students, a major benefit is the promotion of autonomous learning and 21st century skills.

In conclusion, it seems that distance education has greatly contributed to causing a positive impact on the Greek Educational System improving teachers' digital skills empowering teams' collaboration at the same time, which is an attitude emerging from the lack of previous knowledge, expertise, and training.

Further developing and constantly using teachers' newly acquired professional skills is undoubtedly linked to support and training programs, which should be planned and developed by supporting organisations.

Another issue to be further examined is the impact of distance education during the lockdown period. This specific mode of organising the teaching and learning process is considered to have relatively poor academic results compared to face-to-face teaching in both primary and secondary education. It is estimated that many students were promoted to the next class having achieved poor to very poor learning outcomes, a situation that calls for policies that will support these students.

1.3.   Research findings for Italy

The results of the research are presented in sections 1.3.1 to 1.3.6, and the conclusions in section 1.3.7.

1.3.1. Demographic outlook

Table 3.1 presents the frequency and the percent distribution of teaching experience of forty one (41) survey participants who were teachers' (39 out of the total 41), one was Principal or deputy Principal and one was inconclusive. Respectively, thirty five (35) were women and six (6) men.

Table 3.2 shows the age characteristics of the participants.

Table 3.1. Years of Teaching Experience

Years of Teaching Experience	Number	Percentage %
< 5 years	2	4,9

6-10 years	6	14,6
11-20 years	14	34,1
21-30 years	11	26,8
>31 years	8	19,5

Table 3.2. Age of the participants

Age of participants	Number	Percentage %
< 31 years old	0	0
31-40 years old	7	17,1
41-50 years old	13	31,7
51-60 years old	11	26,8
> 61 years old	10	24,4

Tables 3.1 and 3.2 indicate that most participants had between 11 and 30 years (60,9 %) teaching experience and that participants with very little teaching experience (<5 years) were minimal (4,9 %). Accordingly, the majority of the participants were older than 30 years old with less teachers in age range of 31-40 and the rest to be distributed almost evenly in the other age groups.

The subject specialism of the teachers is presented in Table 3.3.

Table 3.3. The subject specialism of participants

Subject specialism	Number	Percentage %
Support teacher	3	7,3
Italian, History and Geography	13	31,7
English and French	9	22,0
Mathematics and Physics	6	14,6

Informatics	1	2,4
Other	9	22,0

1.3.2. General information about the lockdown period

Tables 3.4 – 3.6 and Graph 3.1 illustrate findings on how the lockdown period was experienced by Italian teachers.

Table 3.4. Location of spending most time during the lockdown period

Place	Number
Home	41
Partly at home	0
Outside my home	0

Table 3.5. Mode of work during the lockdown period

Mode of work	Number
Teleworking full-time	31
Teleworking part-time	9
No teleworking	1

Apparently, all teachers spent most of their time at home. Also, 73,8% of them were teleworking full-time and 22,0% of them were teleworking part-time. One of them didn't telework, maybe the principal/deputy principal.

Table 3.6. Emotions experienced during the lockdown period

Happy		Secured		Disoriented		Angry		Anxious	
Not at all	17	Not at all	10	Not at all	6	Not at all	12	Not at all	5
A little	17	A little	21	A little	14	A little	16	A little	16
Somewhat	7	Somewhat	10	Somewhat	20	Somewhat	11	Somewhat	20
A lot	0	A lot	0	A lot	1	A lot	2	A lot	0

Graph 3.1. Emotions experienced during the lockdown period
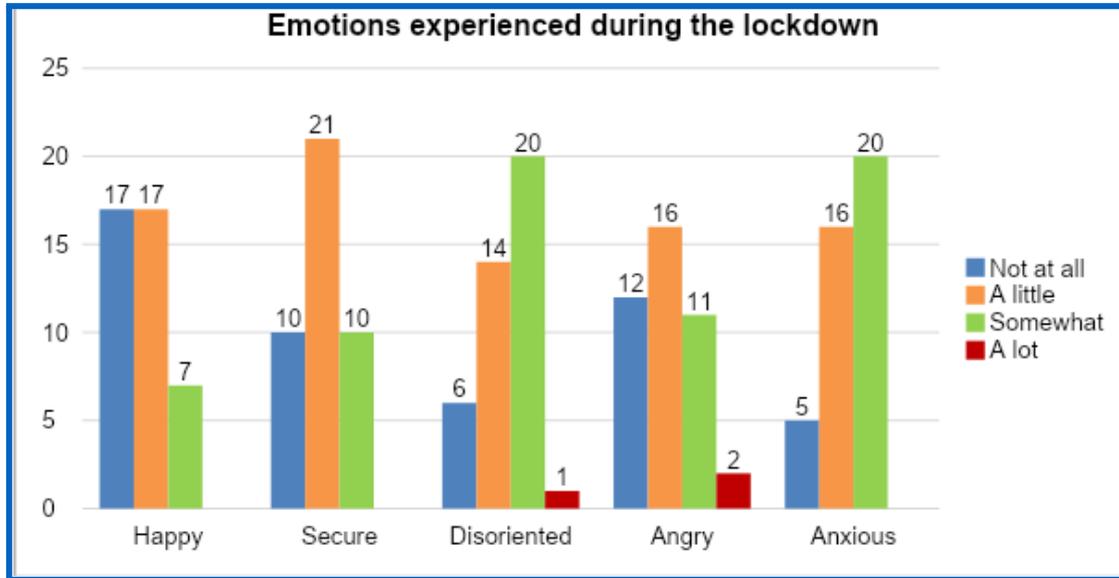
A large part of the teachers experienced negative emotions during the lockdown period, such as unhappiness (41.5%), moderate or strong insecurity (75.6%), disorientation (51,2%) and moderate anxiety (48,8%). Also, a significant percentage of teachers (31,7%) experienced moderate or intense anger.

1.3.3. Digital devices and applications used in distance education

Tables 3.7-3.9 and Graphs 3.2 – 3.4 are indicative of digital devices and digital applications usage before, during and after the lockdown period.

Table 3.7. Digital devices usage before, during and after the lockdown

	Before	**During**	**After**
Desktop	13	13	16
Laptop	32	35	35
Tablet	23	21	23
Smartphone	32	32	33

Graph 3.2. Digital devices usage before, during and after the lockdown
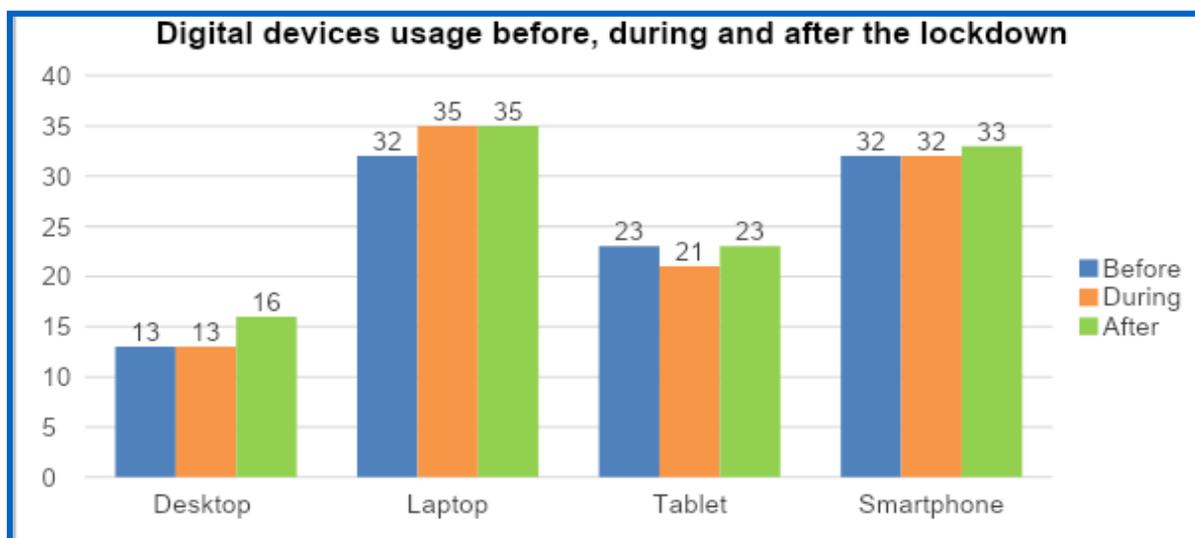
Regarding the frequency of digital devices usage, a slight increase in the usage of Desktop, Laptop and Smartphone after the lockdown period is noted.

Table 3.8. Digital applications usage for distance education before and after the lockdown

	Before (often and always)	After
e-mail	34	29
sms	21	10
Social networks	30	24
Digital platforms approved by the Ministry of Education (e-class, e-me, etc.)	34	37
LMS (Moodle, Edmondo etc)	11	8
Online Teleconference Systems (Zoom, Webex, Teams etc)	13	18
Digital textbooks approved by the Ministry of Education	15	4
Other digital textbooks	8	10
Video platforms (YouTube, Vimeo, etc)	18	18
Websites, Tools, Applications, Repositories etc. approved by the Ministry of Education	20	11
Other Websites, Tools, Applications, Repositories etc.	14	8
Personal Website or Blog	11	3

Graph 3.3. Digital applications usage for distance education before and after the lockdown
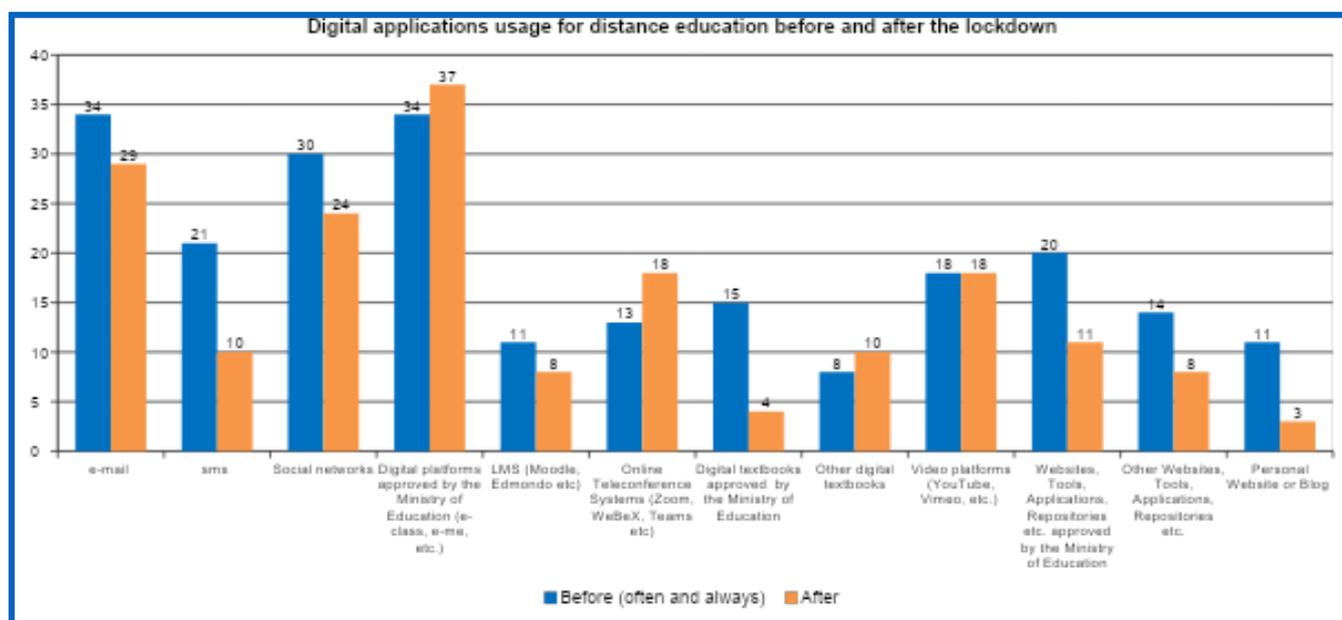
It is clear that after the lockdown the usage of three digital applications is increased, while the usage of the others is decreased.

In particular, the findings indicate an increase for the following applications:

a) Online Teleconference Systems (Zoom, Webex, Teams etc.), increased by 38,5%.

b) Other digital textbooks, increased by 25,0 %.

c) Digital platforms approved by the Ministry of Education (e-class, e-me, etc.), increased only by 8,8 %.

For the following applications a significant decrease is noted.

a) Personal Website or Blog, decreased by 72,3%.

b) Digital textbooks approved by the Ministry of Education decreased by 60,0%.

c) sms, decreased by 52,4%.

d) Websites, Tools, Applications, Repositories etc. approved by the Ministry of Education, decreased by 45,0 %.

e) Other Websites, Tools, Applications, Repositories etc., decreased by 42,9%.

f) LMS (Moodle, Edmodo etc.), decreased by 27,3%.

g) Social networks decreased by 20,0%.

h) e-mail, decreased by 14,7%.

1.3.4. The emergence of innovative teaching practices

Tables 3.9 - 3.11 and Charts 3.4 - 3.7 put forward comparative data on innovative teaching practices and methodologies before and after the lockdown period.

Table 3.9. Teacher practices usage Before and After the lockdown period

	often and always Before	often and always After
Digital Homework	16	24
Digital communication with students (support messages/comments, feedback etc.)	9	26
Digital sharing of teaching material and resources	15	30
Digital sharing of lessons content with colleagues	6	17
Teleconferences with Colleagues	6	31
Teleconferences with Stakeholders	2	22

Graph 3.4. Teacher practices usage Before and After the lockdown period
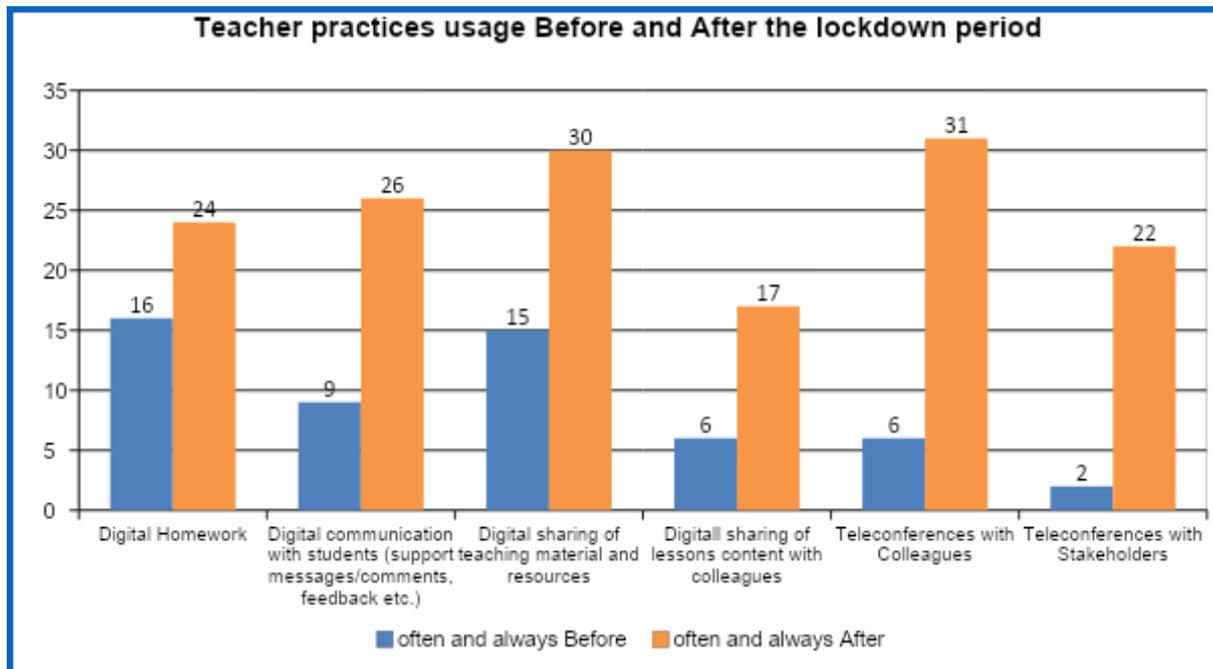
Findings show a striking high percentage increase of all practices under examination.

● Teleconferences with Stakeholders increased by 1000,0%.

● Teleconferences with Colleagues increased by 416.7%.

- Digital communication with students (support messages/comments, feedback etc.) increased by 188,9%.

- Digital sharing of lessons content with colleagues increased by 183.3%%.

- Digital sharing of teaching material and resources increased by 100.0%.

- Digital homework increased by 50.0%.

Table 3.10. Methodological approaches usage before, during and after the lockdown

	Collaborative Learning practices	Flipped Classroom	Blended Learning	Differentiated approach	Interdisciplinary approach (STEAM, CLIL, etc)	Project-based Learning	Other
Before	32	16	4	24	0	10	1
During	26	20	16	23	0	7	2
After	32	26	19	23	0	9	1

Other: G-Suite, conceptual map – video - diagram and traditional methods.

Graph 3.5. Methodological approaches usage before, during and after the lockdown
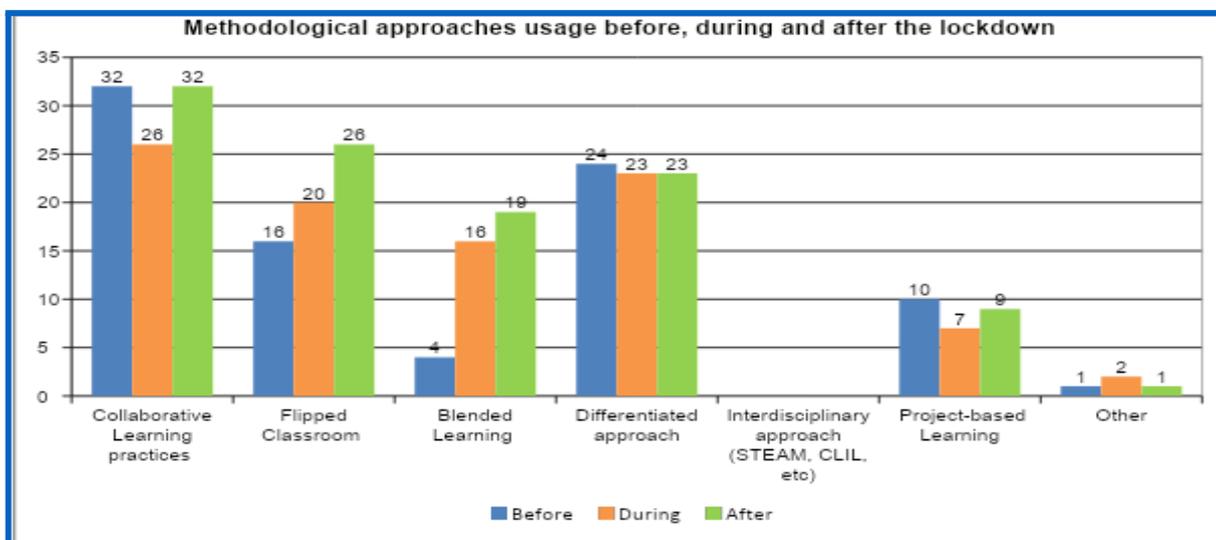
With reference to the usage of methodological teaching practices the research findings indicate that:

a) Before the lockdown, the main methodological practices were Collaborative Learning soaring to 78% and Differentiated approach at 58,5%. Flipped Classroom (39,0%) and Project-based Learning (24,4%) approaches were also adopted but to a much lesser extent.

b) During the lockdown, Blended Learning proved to be a favourable approach soaring to 375% whereas the use of Flipped Classroom increased by 25,0%.

c) After the lockdown, Collaborative Learning practices continue to be the most commonly adopted teaching approach soaring to 78.0%. However, Flipped Classroom increasing to 63,4% and Blended Learning increasing to 46,3% respectively are followed by more and more teachers. Differentiated approach at 56,1% and Project-based Learning at 22.0% represent the same percentages.

d) It is noteworthy that the Interdisciplinary approaches such as STEAM, CLIL, etc. are not at all followed in Italy.

Table 3.11. Remote collaboration and views exchange during the lockdown

Students	Collegues from my school	Collegues from other schools	Principals, deputy-Principals or Educational Advisors of my school	Principals, deputy-Principals or Educational Advisors of other schools	Academic Advisors, school Inspectors, Educational Coordinators etc.	External partners
39	39	12	35	2	5	4

Graph 3.6. Remote collaboration and views exchange during the lockdown
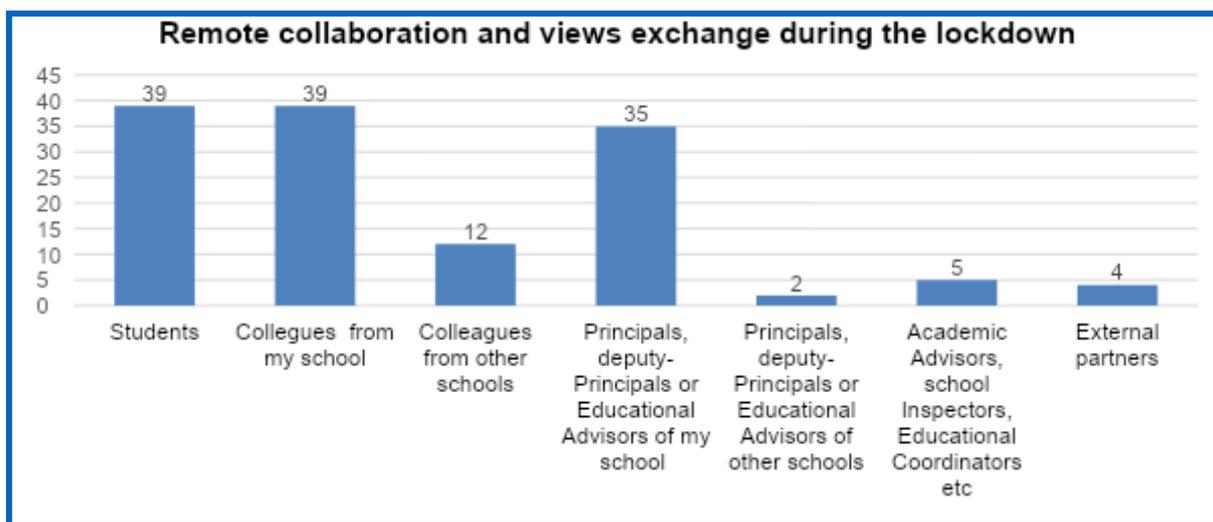
Teachers mainly used:
a) Collegues from their school (95,1%),
b) Students (95,1%) and

c) Principals, deputy-Principals or Educational Advisors of their school (85,4%)

but to a much lesser extent they cooperate and exchange views with colleagues from other schools (29.3%).

1.3.5. Problems, difficulties and benefits arising from the distance education period

Tables 3.12- 3.14 and Graphs 3.7- 3.9 present teachers' views on obstacles, difficulties and benefits associated with distance learning period.

Table 3.12. Main obstacles to ensure educational continuity between school and family, during the lockdown

Families' lack of digital devices	Risk of increasing digital divide and inequalities	Cultural or social distance between students and school	Difficulties in designing effective distance lessons	Difficulties in cooperating with families	Increase of students' autonomy doing tasks and activities	Additional difficulties in managing teaching and learning in distance education	School is seen as the only place to learn	Education in general is not seen as sufficiently open and accessible	Other
28	4	15	7	0	9	23	10	4	1

Other: Great difficulty in performing the educational project remotely compared to the relevant process in face-to-face teaching.

Graph 3.7. Main obstacles to ensure educational continuity between school and family, during the lockdown
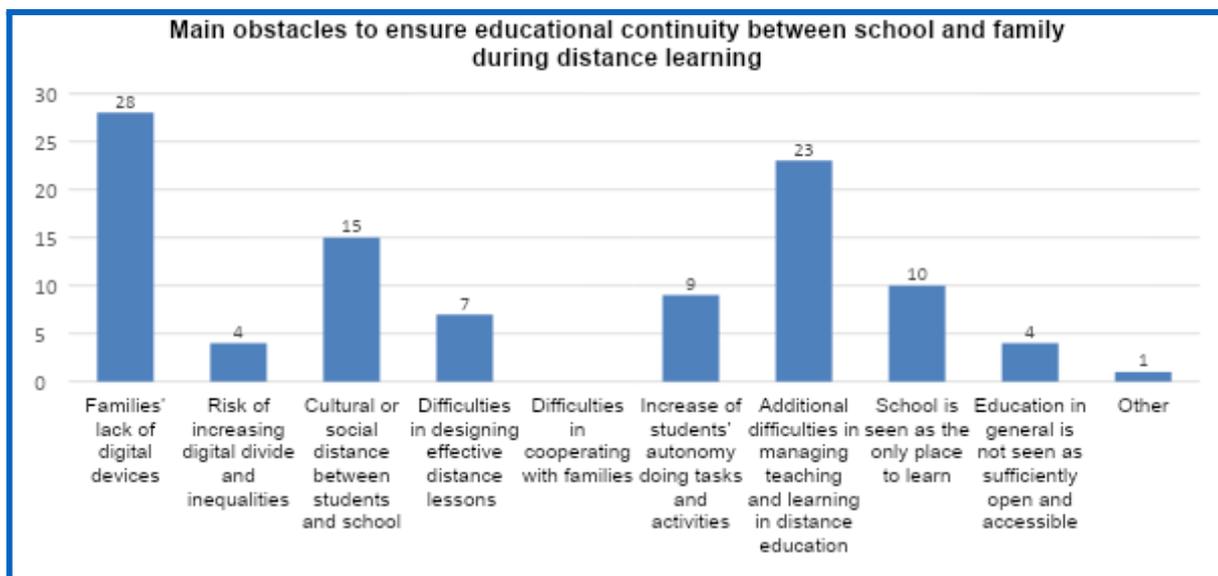
Other: Great difficulty in performing the educational project remotely compared to that performed face to face (1/41).

The main obstacles and concerns expressed by teachers regarding distance learning are:

a) Families' lack of digital devices (68.3%).

b) Additional difficulties in managing teaching and learning in distance education (56.1%).

c) Cultural or social distance between students and school (36,6%).

d) School is seen as the only place to learn (24.4%)

e) Increase of students' autonomy doing tasks and activities (22.0%).

Table 3.13. Main challenges of distance education

The model of teaching approaches	Assessment reliability	Following curricula	Managing teaching/ learning time	Inequalities among students (e.g. internet access, use of tools, etc.)	Parents' role	Collaboration with colleagues	Professional inequalities (e.g. internet access, use of tools, etc.)
17	23	3	15	36	14	3	10

Graph 3.8. Main challenges of distance education
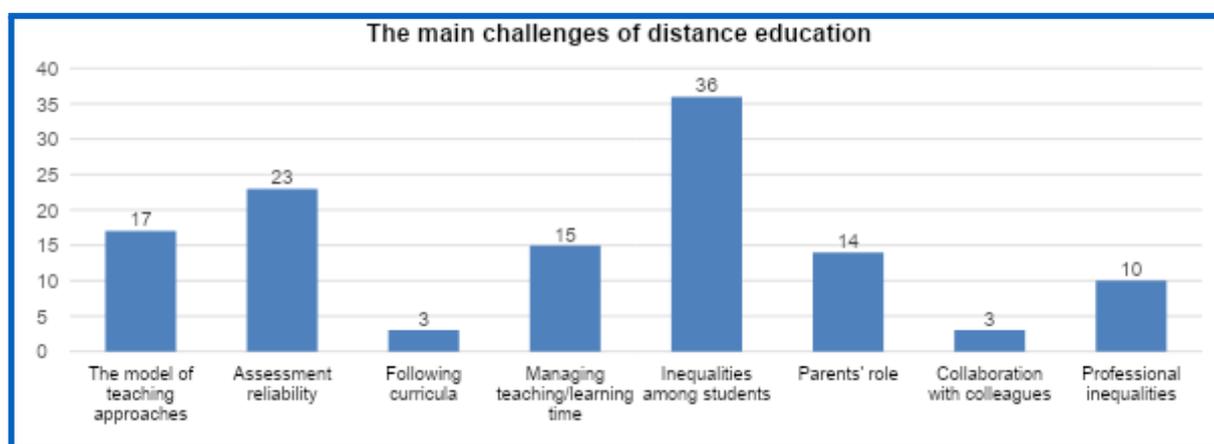
Teachers point out as the most important challenges of distance education the following:

a) Inequalities among students (e.g., internet access, use of tools, etc.) (87.8%).

b) Assessment reliability (56.1%).

c) The model of teaching approaches (41,5%).

d) Managing teaching/learning time (36.6%).

e) Parents' role (34.1%).

f) Professional inequalities (e.g., internet access, use of tools, etc.) (24.4%).

Table 3.14. Main advantages of distance education.

Having more flexibility in the management of resources and activities	Maintaining socio-psychological bonds with students remotely	Supporting the learning process for each student	Reinforcing student autonomy	Reinforcing school-family relation	Developing 21st century skills	Other
25	11	13	19	6	16	2

Other: The distance learning has to be eliminated from school curricula (1) and I don't think there are any advantages in distance learning (1).

Graph 3.9. Main advantages of distance education
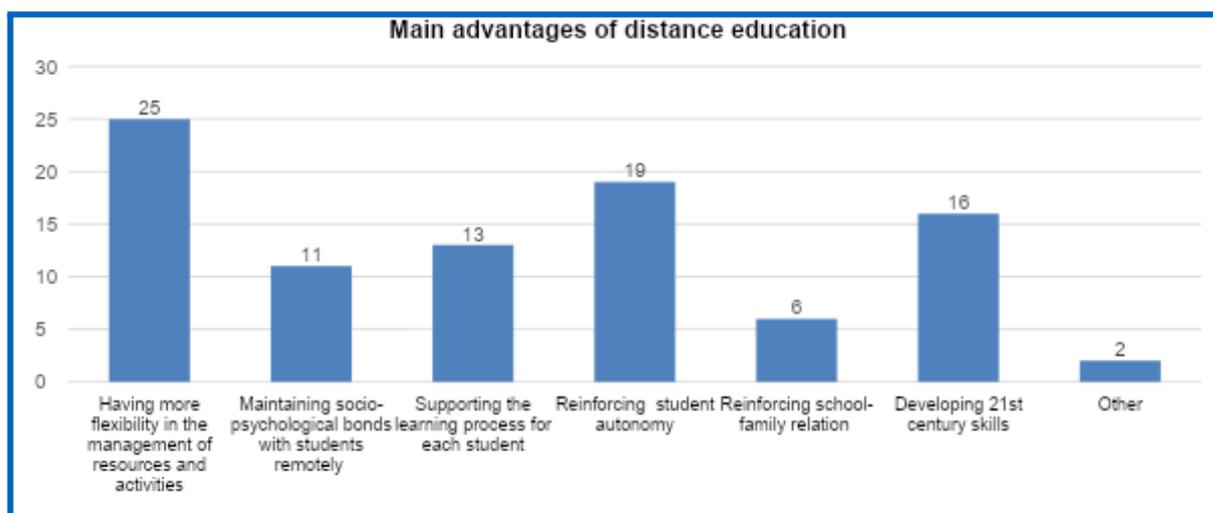
The main advantages of distance education according to the participants are:

   a) Having more flexibility in the management of resources and activities (61.0%).

   b) Reinforcing student autonomy (46,3).

   c) Developing 21st century skills (39.0%).

   d) Supporting the learning process for each student (31,7%)

   e) Maintaining socio-psychological bonds with students remotely (26.8%).

1.3.6. Principals' perceptions about the lockdown period

The three interviews conducted provided either unanimous or clearly converging views as follows:

- The lockdown period changed the way Principals organized their work and communicated with teachers. They also needed to be more guiding and emotionally supportive for certain teachers.
- Students had difficulties in the use of technological equipment and they were not familiar with distance lessons.
- A number of teachers did not have the technical skills that distance education requires.
- Although the Ministry of Education allocated financial resources, they were allocated through time-consuming bureaucratic procedures, which resulted in significant delays in securing the necessary resources and tools (mobile devices and notebooks). Moreover, private schools were not financially supported by the Ministry of Education.
- The digital tools most commonly used in schools before and during the COVID period were Google Meet and Zoom.
- Communication with parents and guardians was achieved, through the use of a variety of digital tools such as Weschool, Google Meet, Zoom, Facebook and Tic Toc, as well over the telephone.
- Principals communicated mainly with the third sector companies, in order to help families with socio-economic problems.
- Main benefit of this period is the growth of the digital skills of the teachers and Principals. Principals highlighted especially Google Meet, Zoom και Google Classroom, and reported that they will use digital tools and teleconferences more often.
- Finally, some innovative practices during this period were:
  a) The creation of online groups for teachers.
  b) The implementation of certain workshops and outdoor lessons, along with the use of podcasts in foreign languages teaching.

1.3.7. Conclusions on Italy

Distance education in Italy was implemented via teleconferences organized by teachers from home, while about half of the teachers felt insecure, disoriented and anxious feeling more or less unhappy.

A minimal percentage increase was observed in digital devices after the lockdown period and fluctuations regarding the use of digital applications. In particular, Online Teleconference Systems (Zoom, Webex, Teams etc.) and other digital textbooks gains ground, while personal websites or blogs, digital textbooks and applications approved by the Ministry of Education, sms, websites, tools, and other websites, tools, applications etc. became less popular.

In the post-lockdown period the findings indicate a high increase of practices used by teachers regarding various types of digital communication channels with colleagues,

students and parents or guardians. Also, the lockdown period seems to have a positive impact occurring in the following aspects:

- Collaborative practices among teachers through sharing of teaching materials, lesson plans and communication via teleconferencing.

- Communication with students assigning them digital homework, providing digital support messages, and digital feedback.

- Communication with parents and guardians via teleconferences.

Regarding the methodological teaching practices, the main beneficiaries of distance education are Flipped Classroom and Blended Learning approaches. On the other hand, Collaborative Learning practices and the Differentiated approach still maintain their popularity among teachers.

It is noteworthy that Interdisciplinary approaches such as STEAM, CLIL, etc. are not at all followed in Italy.

Teachers to a great extent cooperated and exchanged views with colleagues from their school, students and Principals, Deputy-Principals and Educational Advisors of their school during distance education in a rather balanced way. To a much lesser extent they cooperated and exchanged views with colleagues from other schools.

The main obstacles holding up progress regarding the effectiveness of distance learning were both the lack of family digital devices as well as difficulties arising from the additional difficulties in managing teaching and learning in distance education.

Negative effect also had: the cultural or social distance among students, that school is seen as the only place to learn and the increase of students' autonomy doing tasks and activities.

The main challenges teachers faced, in descending order, were: to bridge the inequalities among students (e.g. internet access, use of tools, etc.), to perform reliable assessment, to shape the appropriate model of teaching approach, to manage teaching/learning time, to make good use of parents' role and to limit the professional inequalities (e.g. internet access, use of tools, etc.) between teachers.

According to the participants, distance education contributed positively to teachers regarding the greater flexibility in the management of resources and activities and to students regarding the reinforcement of their autonomy and the development of 21st century skills. To a lesser extent allowed them to support the learning process for each student and to maintain a socio-psychological bond with students remotely.

Also, in Italy the same questions arise:

- To which extent distance education was effective during the lockdown period?

- How many students were promoted to the next class while having poor to very poor learning outcomes and how does the educational system support them and face this issue, which is of major importance?

1.4. Cumulative research findings for the three countries

Comparison, interpretation and synthesis of significant research findings among all three countries participating in the present study revealed both similarities and differences amongst them. Thus, it was deemed necessary to be presented in detail, as follows:

a) Concluding summary of the cumulative findings of this research.

b) Comparative analysis and interpretation among the participating countries.

This process focuses on emotions, digital applications, teacher and teaching practices as well as obstacles, challenges and advantages that emerged during transition from face-to-face to distance education due to lockdown restrictions.

The findings obtained from measured data regarding research evidence as well as their comparative analysis are presented in sections 1.4.1 to 1.4.5 whereas the conclusions drawn are presented in section 1.4.6.

1.4.1. Emotions experienced during the lockdown period

The percentage comparative analysis of the emotions experienced by teachers in the three countries was deemed appropriate to be divided into two dimensions, the dimension of being happy and secure and the dimension of being disoriented, angry and anxious. Tables 4.1 and 4.2 and Graphs 4.1 and 4.2. present these data.

Table 4.1. Percentage findings regarding emotions of not at all and a little happy and secure per country

	Not at all and a little happy	**Not at all and a little secure**
Cyprus	92,6**%**	74,1**%**
Greece	66,7**%**	35,3**%**
Italy	82,9**%**	75,6**%**
Total (N=119)	93 teachers (78,2%)	69 teachers (58,0%)

Graph 4.1. Percentage findings regarding emotions of not at all and a little happy and secure per country
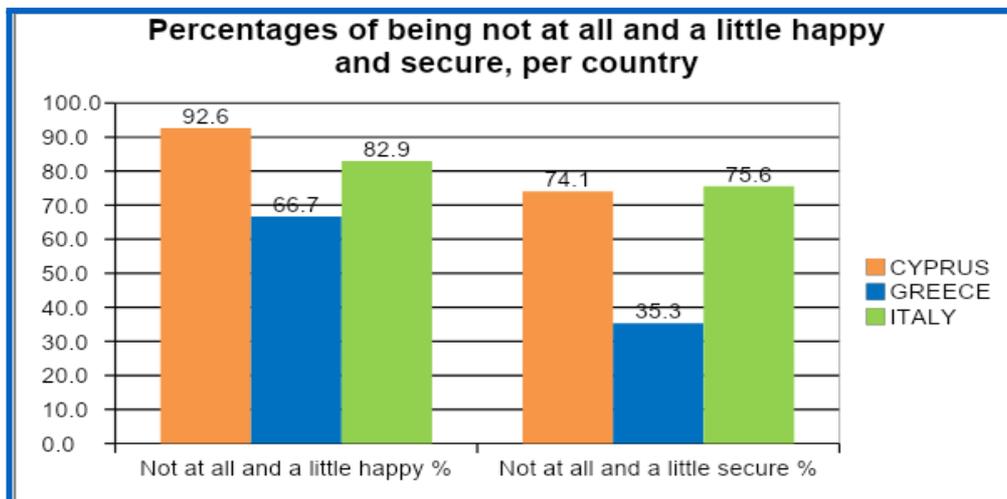
Table 4.2. Percentage findings regarding emotions of somewhat and a lot disoriented, angry and anxious per country

|	**Somewhat and a lot disoriented**	**Somewhat and a lot angry**	**Somewhat and a lot anxious**
Cyprus	37,0%	18,5%	51,9%
Greece	31,4%	19,6%	43,1%
Italy	51,2%	31,7%	48,8%
Total (N=119)	47 teachers (39,5%)	28 (23.5%)	56 (47,1%)

Graph 4.2. Percentage findings regarding emotions of somewhat and a lot disoriented, angry and anxious, per country
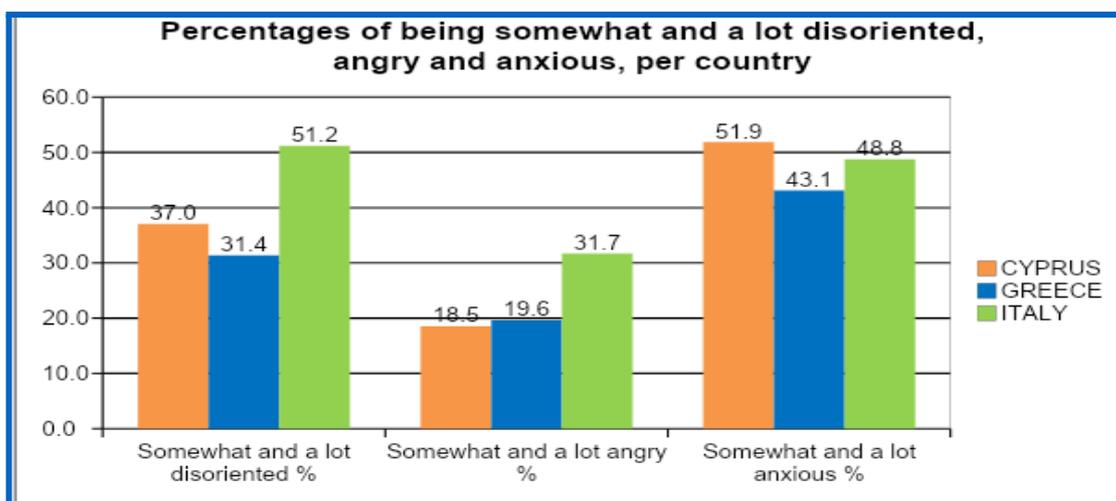
Analysing the above findings, it becomes obvious that in all three southern European countries the teachers implemented distance education being in a rather to very unfavourable emotional state. Besides, not at all and little happy were the 78,2% of participants, not at all and little secure were the 58,0% while somewhat and a lot anxious were the 47,1% and 39,5% of them felt disoriented.

Comparing findings among the three countries it is concluded that the Greek teachers were in a much better emotional state than their Italian and Cypriot colleagues during the lockdown period as long as they felt much more secure, a little more happy and a little less disoriented and anxious.

1.4.2. Digital applications used in distance education

Research data for the use of digital applications before and after the lockdown period for all participants are shown in Table 4.3 and Graph 4.3.

Table 4.3. Digital applications usage for distance education before and after the lockdown

(N=119)	often and always Before	After
e-mail	34	29
sms	21	10
Social networks	30	24
Digital platforms approved by the Ministry of Education (e-class, e-me, etc.)	34	37
LMS (Moodle, Edmondo etc.)	11	8
Online Teleconference Systems (Zoom, Webex, Teams etc.)	13	18
Digital textbooks approved by the Ministry of Education	15	4
Other digital textbooks	8	10
Video platforms (YouTube, Vimeo, etc.)	18	18
Websites, Tools, Applications, Repositories etc. approved by the Ministry of Education	20	11
Other Websites, Tools, Applications, Repositories etc.	14	8
Personal Website or Blog	11	3

Graph 4.3. Digital applications usage for distance education before and after the lockdown
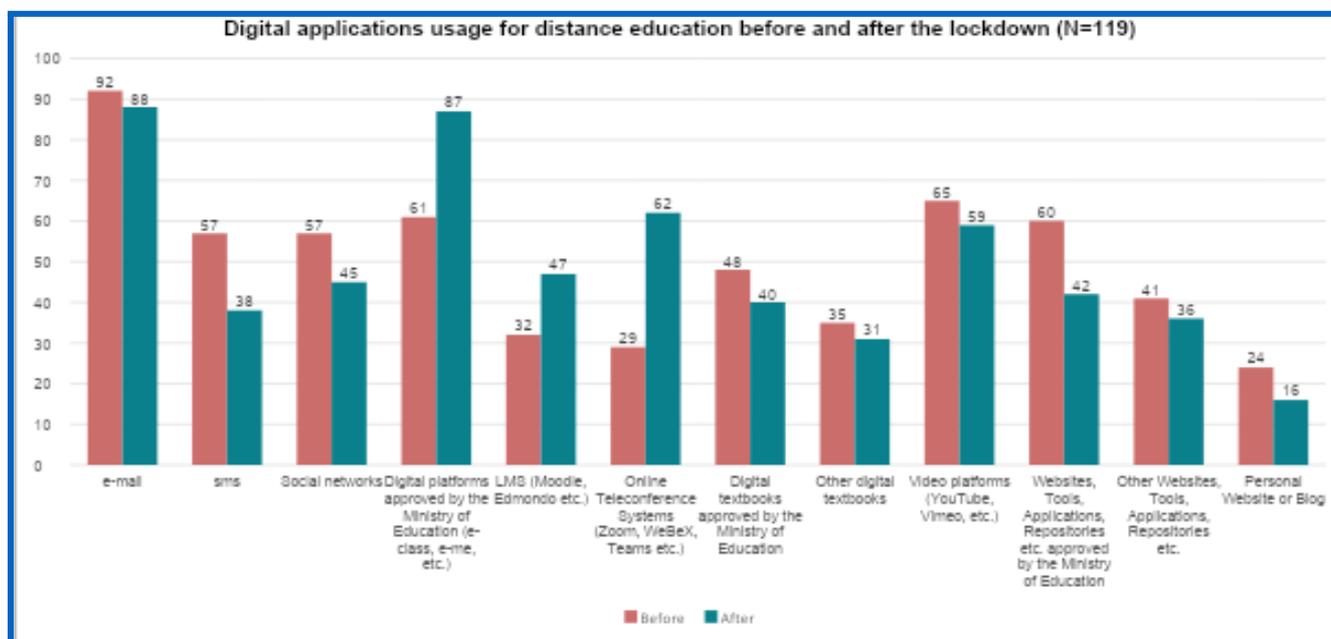
Research findings clearly indicate that there is an increase in the following three applications,

a) Digital platforms approved by the Ministry of Education (e-class, e-me, etc.) whose usage was already widespread (51.3%) whereas 26 more teachers started using them, soaring to 73,1%.

b) Online teleconference systems (Zoom, Webex, Teams etc.) were used by almost one fourth of teachers, (24,4%) and 33 new users were added finally increasing to 52,1%.

c) LMS (Moodle, Edmondo etc.) whose use was increased by 15 new application users increasing to 39,5%.

This increase can be attributed, on the one hand, to the familiarity acquired with these digital applications during the period of distance education while on the other hand to the recognition of their benefits and added-value in the educational process either of face-to-face teaching or distance education.

Obviously, the increase of using the aforementioned applications has the consequential result of the reduction of using other applications and specifically sms, Websites, Tools, Applications, Repositories etc. approved by the Ministry of Education, Social networks as well as Personal Website or Blogs.

1.4.3. The emergence of innovative teaching practices

Tables 4.4 - 4.8 and Graphs 4.4 – 4.8 present comparative data on teachers' practices and teaching methodologies before and after the lockdown period.

Table 4.4. Teacher practices before and after the lockdown period

(N=119)	often and always Before	often and always After
Digital Homework	45	72
Digital communication with students (support messages/comments, feedback etc.)	37	73
Digital sharing of teaching material and resources	44	82
Digital sharing of lessons content with colleagues	26	54
Teleconferences with Colleagues	21	65
Teleconferences with Stakeholders	10	52

Graph 4.4. Teacher practices before and after the lockdown period
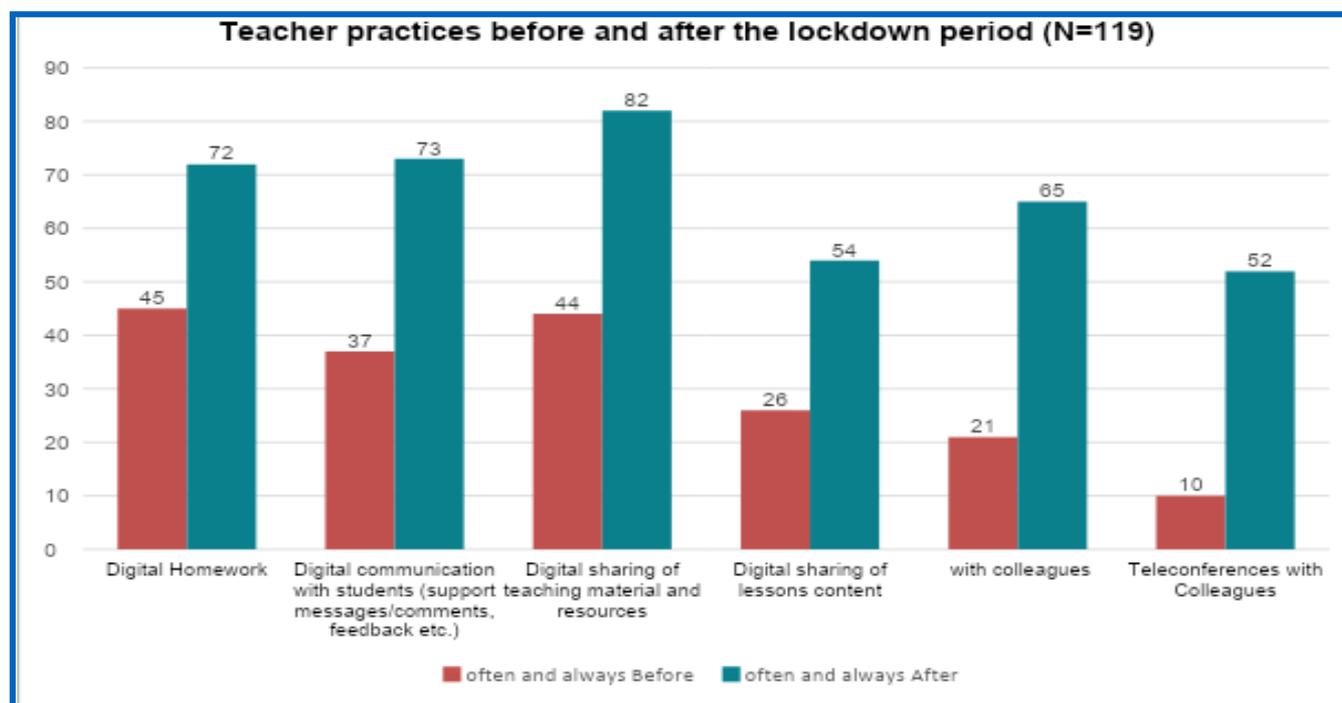
The use of teleconferencing with stakeholders increased fivefold whereas with colleagues is tripled.

The digital sharing of material, resources and lessons content with colleagues is approximately doubled.

Digital communication with students (support messages/comments, feedback. etc.) is doubled, while digital homework increased by 1.6 times.

Table 4.5. Percentages of methodological approaches before the lockdown per country

	Collaborative Learning practices %	Flipped Classroom %	Blended Learning %	Differentiated approach %	Interdisciplinary approach (STEAM, CLIL, etc) %	Project-based Learning %	Other %
Cyprus	88,9	11,1	51,9	59,3	37,0	48,1	11,1
Greece	70,6	23,5	45,1	39,2	31,4	70,6	0,0
Italy	78,0	39,0	9,8	58,5	0,0	24,4	0,0

Graph 4.5. Percentages of methodological approaches before the lockdown per country
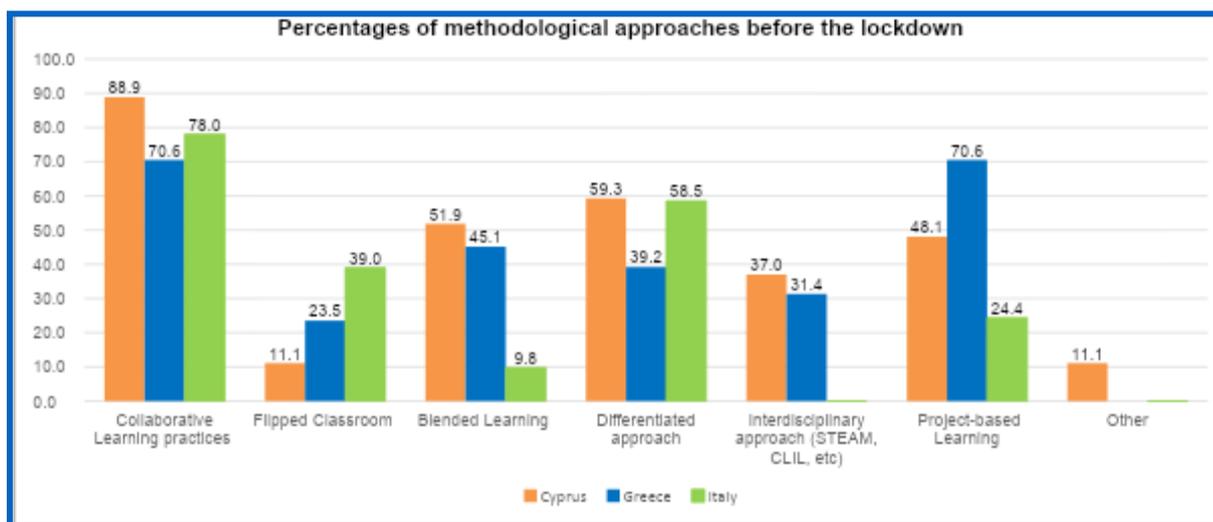
Table 4.6. Percentageς of methodological approaches after the lockdown per country

	Collaborative Learning practices %	Flipped Classroom %	Blended Learning %	Differentiated approach %	Interdisciplinary approach (STEAM, CLIL, etc.) %	Project-based Learning %	Other %
Cyprus	92,6	18,5	77,8	66,7	55,6	40,7	0,0
Greece	76,5	31,4	52,9	35,3	27,5	64,7	3,9
Italy	78,0	63,4	46,3	56,1	0,0	22,0	2,4

Graph 4.6. Percentages of methodological approaches before the lockdown per country
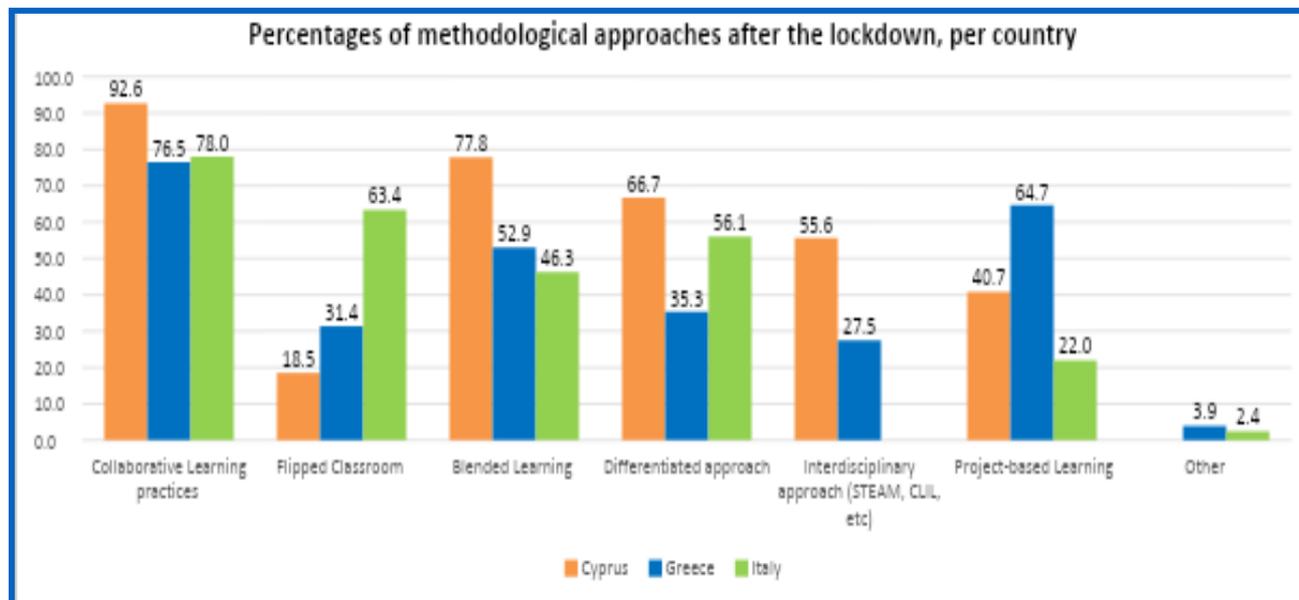
The analysis of the findings among the three participant counties, namely Cyprus, Greece and Italy before the lockdown period indicates that Collaborative Learning practices, Differentiated approach, Blended Learning and Interdisciplinary approach were adopted and followed more frequently in Cyprus. Flipped Classroom was more frequently used in Italy whereas Project-based Learning was a more frequent approach in Greece.

After the lockdown period, Collaborative Learning practices, Differentiated approach, Blended Learning and Interdisciplinary approach ended up being used more frequently in Cyprus and Flipped Classroom in Italy, while in Greece the Project-based Learning was followed a little less frequently. Moreover, comparing the use of the Blended Learning approach it increased more in Cyprus while the Flipped Classroom increased more in Italy.

It is noteworthy that the Interdisciplinary approach seems not to be adopted at all in Italy.

In summary, two trends are obviously observed:

a) Consistency in the use of Collaborative Learning, Differentiated approach and Project-based Learning before and after the lockdown.

b) An obvious increase in the use of Blended Learning and Flipped Classroom after the lockdown. The former has the greatest increase and becomes a fairly common methodological approach in all participating countries and the latter becomes a fairly common methodological approach only in Italy.

Table 4.7. Methodological approaches before, during and after the lockdown period for all participants

(N=119)	Collaborative Learning practices	Flipped Classroom	Blended Learning	Differentiated approach	Interdisciplinary approach (STEAM, CLIL, etc)	Project-based Learning	Other
Before	92	31	41	60	26	59	4
During	81	46	62	60	27	56	4
After	96	47	67	59	29	53	3

Graph 4.7. Methodological approaches before, during and after the lockdown period for all participants
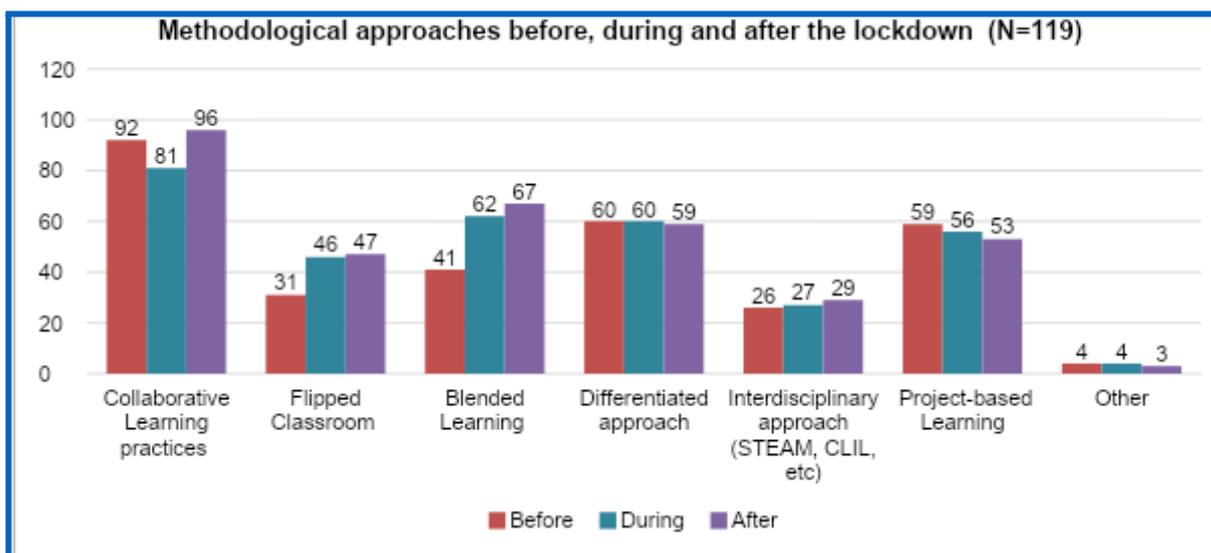
These findings confirm the previously mentioned trends, which in the future presumably will have a long-term and lasting effect on educational systems, namely the stability of using the more traditional methodological approaches in combination with a significant increase in the use of innovative methodological approaches, which, obviously, were more frequently adopted during the period of distance education.

It is worth mentioning that Blended Learning can already be included in the most frequently methodological practices used, while Flipped Classroom has not yet reached this level of usage among teachers but is approaching it.

Table 4.8. Percentages of remote collaboration and views exchange during the lockdown, per country

	Cyprus %	Greece %	Italy %
Students	51,9	78,4	95,1
Colleagues from my school	92,6	98,0	95,1
Colleagues from other school	40,7	58,8	29,3
Principals, deputy- Principals or educational advisors of my school	40,7	64,7	85,4
Principals, deputy- Principals or educational advisors of other schools	11,1	3,9	4,9
Academic Advisors, school Inspectors etc.	18,5	25,5	12,2
External partners	18,5	21,6	9,8

Graph 4.8. Percentages of remote collaboration and views exchange during the lockdown, per country
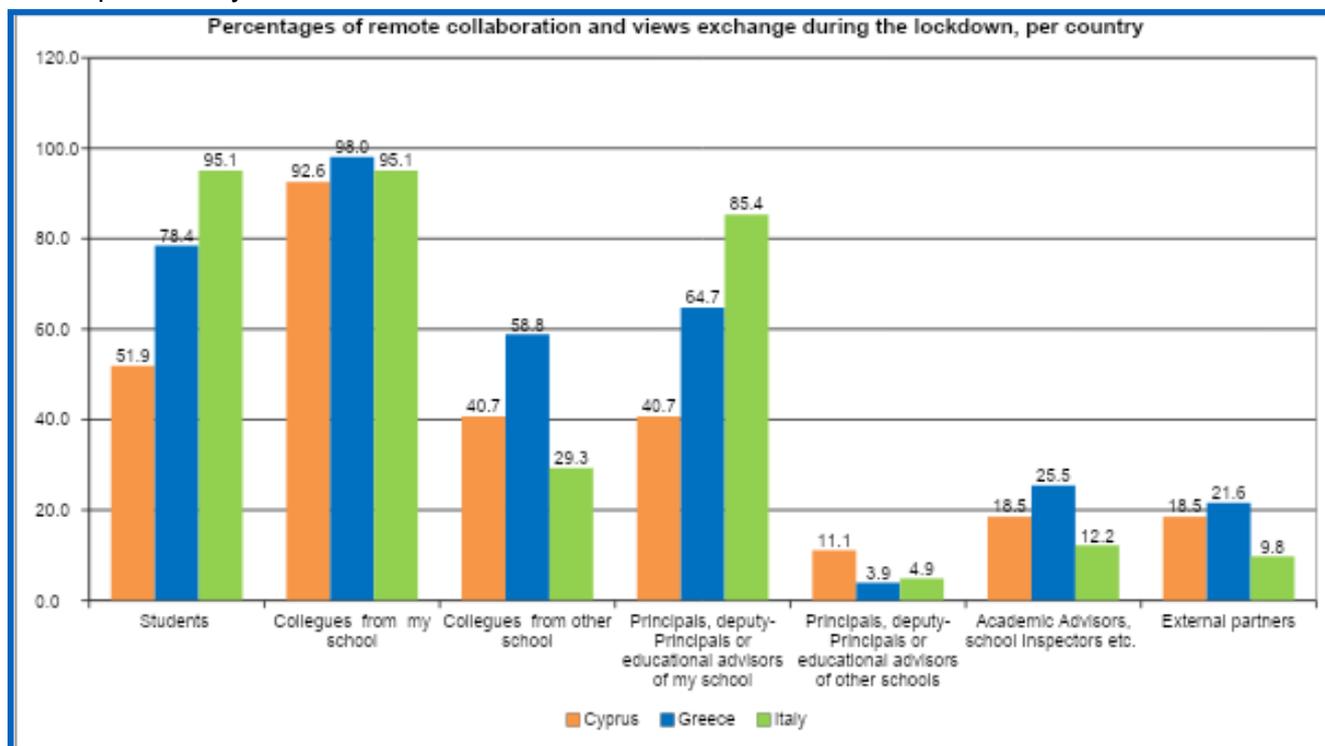
In all of the participating countries in the study, Colleagues from the same school were chosen for cooperation and views exchange at a rate of more than 90%, which is in fact a

very high percentage. Of great value for cooperation and views exchange proved to be the Students, as well as the Principals, Deputy Principals and school support team and, last but not least, colleagues from other schools.

As regards the supporting persons and groups with whom remote collaborations and exchange views were established, there are significant differences from country to country.

Italian teachers establish collaborations and views' exchange with colleagues, students and Principals, deputy Principals and the school support team (appointed by the Teachers' Board) of their school with, more or less, the same or roughly approximate high frequencies. Also, they have chosen colleagues from other schools to a much lesser extent.

Cypriot teachers chosen for cooperation and views' exchange were: a) Students, b) Principals, deputy Principals and the school support team and c) colleagues from other schools; the percentage of colleagues from other schools is proportionally half compared to the percentage of colleagues from their own school.

Greek teachers are ranged in between Italian and Cypriot teachers in what concerns this proportionality. They collaborated with colleagues from other schools to a much greater extent than the Cypriot and Italian participants, probably due to the fact that Greek schools have a relatively limited number of students and teachers and also school facilities in Greece are located in a rather short distance between each other.

Finally, Educational Advisors and school Inspectors were used for collaboration and views exchange to a relatively small extent ranging between 10 to 25%, more by Greek teachers and clearly less by the Italian ones.

1.4.4. Problems, difficulties and benefits

Tables 4.9 - 4.12 and Graphs 4.9 – 4.12 present participants' views on obstacles, difficulties and benefits associated with distance learning.

Table 4.9. Main obstacles to ensure educational continuity between school and family during the lockdown (N=119)

Families' lack of digital devices	Risk of increasing digital divide and inequalities	Cultural or social distance between students and school	Difficulties in designing effective distance lessons	Difficulties in cooperating with families	Increase of students' autonomy doing tasks and activities	Additional difficulties in managing teaching and learning in distance education	School is seen as the only place to learn	Education in general is not seen as sufficiently open and accessible	Other
77	26	54	44	33	23	63	28	14	2

Graph 4.9. Main obstacles to ensure educational continuity between school and family during the lockdown
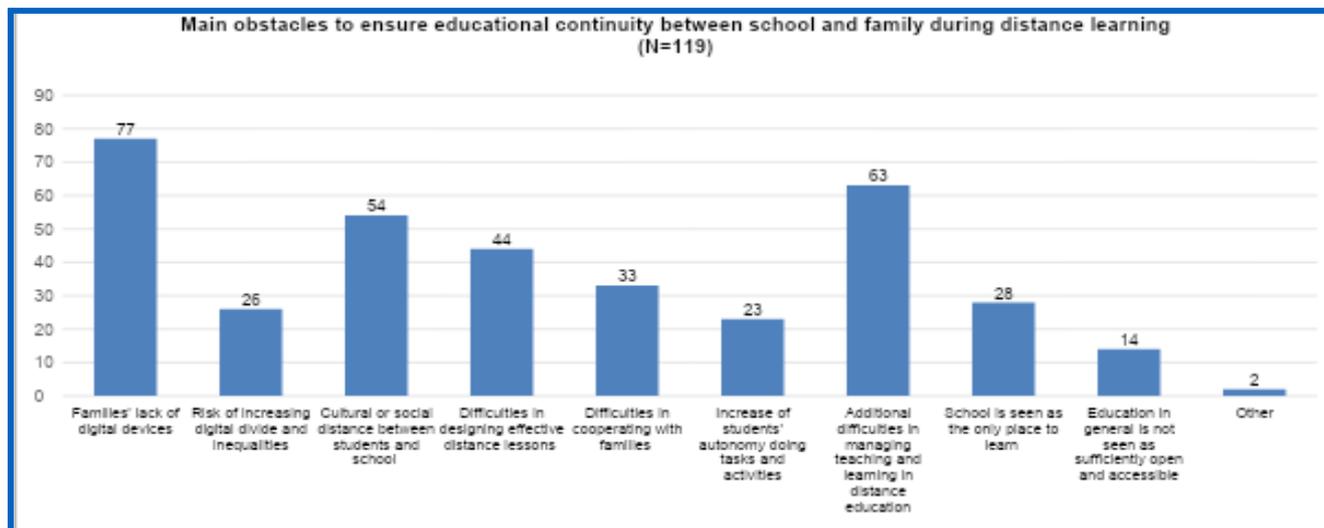
The main obstacles ensuring educational continuity between school and family during the distance education period can be classified into two categories. One is related to the socio-economic and cultural status of each family while the other one is related to difficulties arising in distance education.

The first category includes:
- the lack of digital devices of families at 64.7% and
- the cultural or social distance between students and school at 45.4%.

The second category includes:
- that teaching and learning is more difficult to manage from distance at 54.9% and
- the difficulties in designing very explicit distance courses at 37.0%.

Table 4.10. Percentages of main obstacles to ensure educational continuity between school and family during the lockdown by country

	Families' lack of digital devices %	Risk of increasing digital divide and inequalities %	Cultural or social distance between students and school %	Difficulties in designing effective distance lessons %	Difficulties in cooperating with families %	Increase of students' autonomy doing tasks and activities %	Additional difficulties in managing teaching and learning in distance education %	School is seen as the only place to learn %	Education in general is not seen as sufficiently open and accessible %
Cy	48,1	7,4	59,3	55,6	66,7	18,5	66,7	25,9	14,8%
Gr	70,6	39,2	45,1	43,1	29,4	17,6	43,1	21,6	11,8%
It	68,3	9,8	36,6	17,1	0,0	22,0	56,1	24,4	9,8%

Graph 4.10. Percentages of main obstacles to ensure educational continuity between school and family during the lockdown by country

Percentages of main obstacles to ensure educational continuity between school and family during the lockdown by country
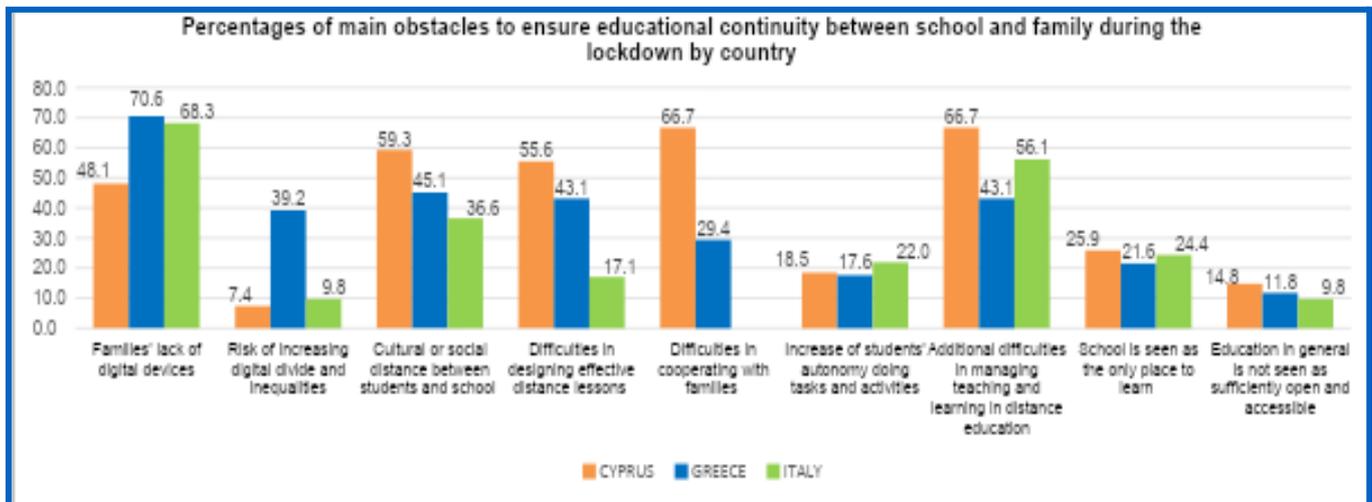
Participants consider as major obstacles "Families' lack of digital devices" (64,7%), "Additional difficulties in managing teaching and learning in distance education" (52,9%), "Cultural or social distance between students and school" (45,4%) and "Difficulties in designing very explicit distance courses" (37,0%).

Cypriot teachers in addition to the above emphasise on "Difficulties in cooperating with families", which was the major obstacle for them alongside with "Additional difficulties in managing teaching and learning in distance education".

"Families' lack of digital devices" is clearly the obstacle of major importance for Greek and Italian teachers.

"Difficulties in cooperating with families" was a minor obstacle regarding Greek teachers, while it was not an obstacle for the Italian teachers.

Table 4.11. Main challenges of distance education (N=119)

The model of teaching approaches	Assessment reliability	Following curricula	Managing teaching / learning time	Inequalities among students (e.g. internet access, use of tools, etc.)	Parents' role	Collaboration with colleagues	Professional inequalities (e.g. internet access, use of tools, etc.)	Delay implementing Interdisciplinary Projects	Other
55	70	30	46	73	43	26	21	12	12

Graph 4.11. Main challenges of distance education.
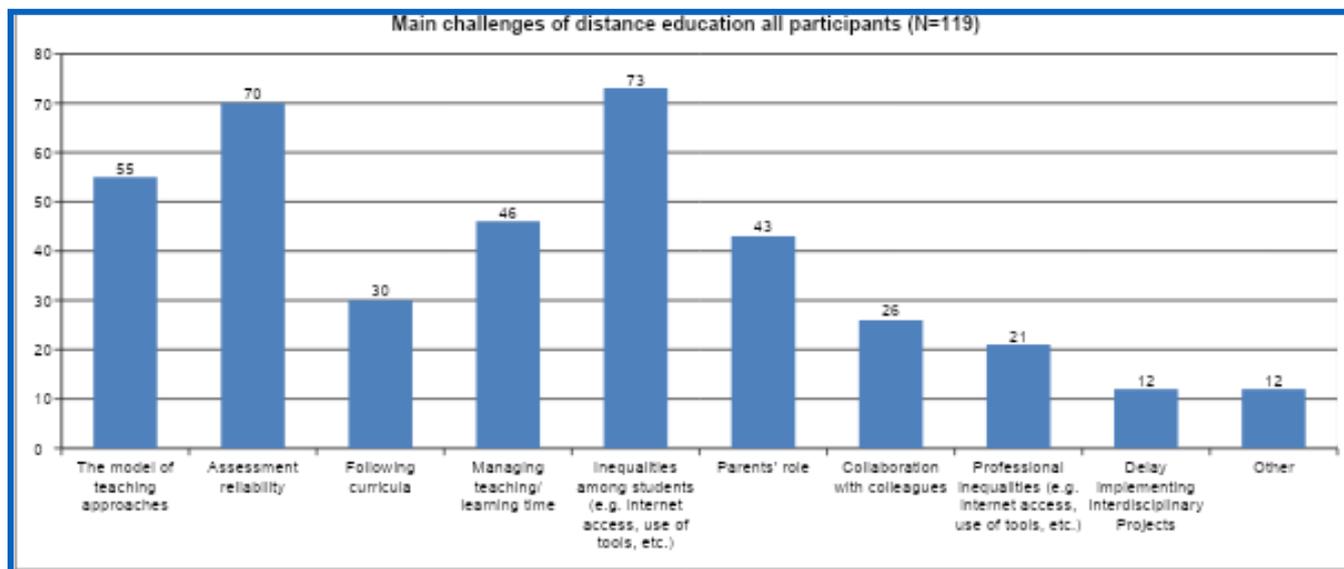
The main challenges of distance education can be classified in the following two categories.

a. The socio-economic and cultural status of the family and

b. the difficulties arising in distance education.

The first category includes:

- Inequalities among students (e.g. internet access, use of tools, etc.) at 61.3%.
- Parents' role at 36.1%.

The second category includes:

- Assessment reliability at 58,8%.
- The model of classroom approaches at 46.2%.
- Managing teaching/ learning time at 38.7%.

If teachers' views are examined by country regarding the above challenges, it seems that Italian teachers consider "Inequalities among students (e.g. internet access, use of tools, etc.)" as the greatest challenge. Greek teachers consider "Assessment reliability" as the major challenge to tackle with. Regarding the rest of the challenges, teachers' views do not differ very much.

Table 4.12. Main advantages of distance education all participants (N=119)

Having more flexibility in the management of resources and activities	Maintaining socio-psychological bonds with students remotely	Supporting the learning process for each student	Reinforcing student autonomy	Reinforcing school-family relation	Developing 21st century skills	Other
78	52	33	58	20	65	2

Graph 4.12. Main advantages of distance education

Main advantages of distance education all participants (N=119)
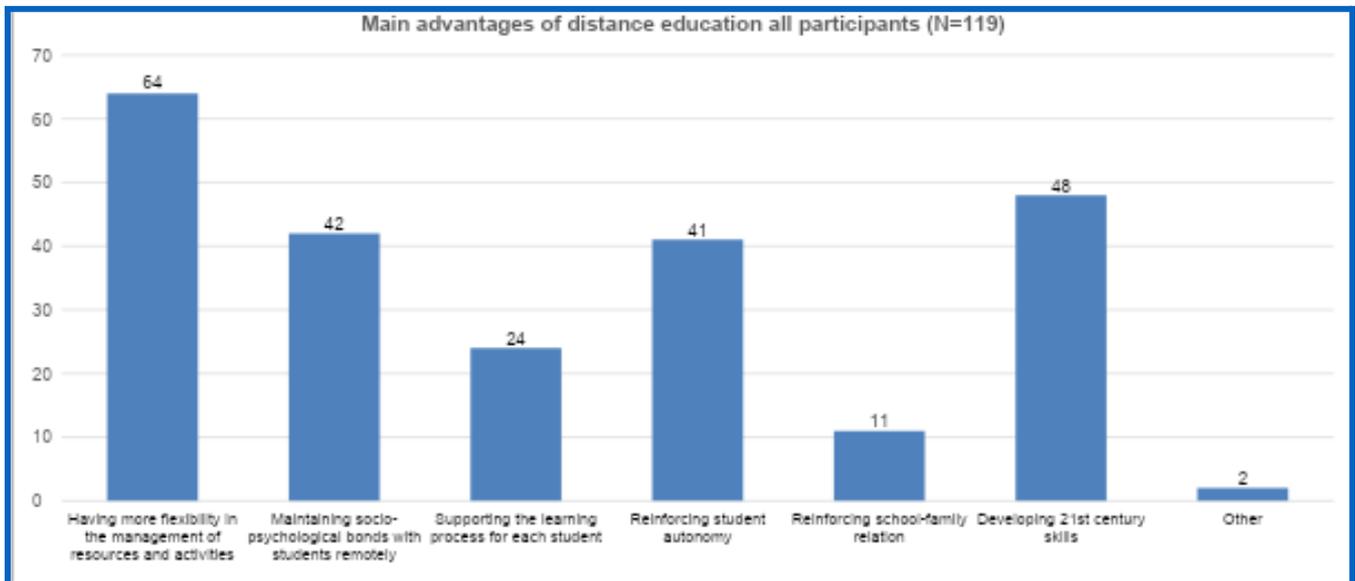
Exploring the answers of the total number of teachers, who took part in the research, four main advantages can be further illustrated as significant:

- Having more flexibility in the management of resources and activities (65.5%).
- Developing 21st century skills (54.6%).
- Developing student autonomy (48.7).
- Maintaining socio-psychological bonds with students remotely (43.7%).

1.4.5. Principals' perceptions about the lockdown period

The findings of the ten (10) interviews are presented below focusing on the points where the Principals' views show either unanimity, i.e. clear convergence between countries or a wide divergence between countries.

Points of unanimity or clear convergence:

a) During the lockdown period, the Principals agree that the way of organising their work changed as well as the way of communicating with the teachers.

b) The most important difficulties they encountered concerned the support many teachers needed as well as a number of students and their families. Some teachers needed support using technological equipment and platforms for providing online and asynchronous education in an effective manner. Some students and their families needed support in accessing and using the technological equipment.

c) Communication with parents and guardians was achieved to a satisfactory degree, primarily via teleconferences and secondarily over the telephone.

d) Schools were provided with the necessary resources and tools by the Ministries of Education, however these resources were not considered sufficient enough. In Italy the Ministry allocated financial resources, but this process was a bureaucratic and time-consuming one which resulted in significant delays in acquiring the necessary equipment (portable devices and notebooks). Besides, in Cyprus the Ministry of Education does not seem to have provided resources to Private schools.

e) The main benefit from the lockdown period is the digital skills development of both teachers and principals.

Points of differentiation:

a) Principals from Cyprus and Greece report that students' had their cameras turned off during the teaching and learning process in distance education and this allowed a number of them not to participate sufficiently in the learning process.

b) In Italy, Principals provide as an efficient solution to addressing the problem the adoption of a series of innovative practices such as the online teacher training in groups, participating in workshops and using podcasts in foreign languages lessons.

c) The issue of technical support of Cypriot teachers was managed mainly by the Teachers of Informatics while in Greece it was addressed mainly by the technical support teams set up in schools which proved to be of major importance to addressing difficulties arising. Teachers of Informatics played an important role in each team. Moreover, the technical teams developed by each Regional Directorate of Education provided support.

d) The scientific support in implementing distance education is reported by the Greek Principals only, who point out the contribution of the Regional Centers of Educational Planning (PE.K.ES.).

e) Support to students and families regarding socio-economic problems faced seem to have taken place only in Italy, with the contribution of third sector companies.

f) In Cyprus, the MS Teams platform was used mainly while in Greece the Webex platform in combination with the e-class and e-me learning management systems addressed the problems arising in distance education whereas in Italy Google Meet and Zoom platforms were adopted as a medium of implementing distance education.

Finally, the Principals deem that in the post-pandemic era there will be an enrichment of teaching practices, mainly through the use of digital tools and video conferencing platforms. However, in Cyprus Principals are rather pessimistic considering that the teachers will finally return to the pre-pandemic teaching practices and methodologies.

1.4.6. Conclusions on research findings regarding the three countries

The three south-eastern European countries have <u>a number of common features</u> in the way they managed the distance education implemented during this period, the difficulties and challenges they faced and the benefits that the educational systems might derive from this period.

Teachers implemented distance education in a quite unhappy, insecure and anxious emotional state.

Distance education familiarized teachers with a series of digital applications, which they will continue using with increased frequency in the post lockdown era as well, due to their undoubted usefulness in the educational process. More specifically, the "Digital environments approved by the Ministry of Education such as e-class, e-me etc», the "Online teleconference systems (Zoom, Webex, Teams etc.)" and the "Learning Management Systems (Moodle, Edmondo etc)" are the ones considered of great importance and value. At the same time, they limited the use of other digital applications, namely "sms", "Social networks", "Personal websites or blogs" and "Websites-tools-applications etc. approved by the Ministry of Education ".

The increase of the use of teleconferencing with stakeholders and colleagues as well as the Digital communication with students is a subsequent result as well.

In terms of the teaching methodologies adopted, we observe two trends:

a) Consistency in the use of the main teaching methodologies before and after the lockdown ("Collaborative Learning practices" which was and stay the most common methodological approach in all three countries, "Differentiated approach" and "Project-based Learning").

b) A clear increase in the use of Blended Learning and Flipped Classroom during and after the lockdown. Blended learning is shown to have the highest increase and has become a fairly common methodological approach in all participating countries, while Flipped Classroom has not yet reached the desired level of adoption as a favourable and frequent approach but it is steadily increasing.

During the distance education period, teachers had in hand a variety of resources for collaboration and systematic exchange of views. Their first choice was the colleagues from the same school and the second one were their students. Other resources were "Principals and Deputy Principals and Educational Advisors of their school" and "Colleagues from other schools.

A common obstacle was the support some teachers needed regarding the use of technological equipment and platforms in order to organize and provide online and asynchronous education in an effective manner.

With reference to the educational continuity between school and family, the teachers participating in the survey highlighted two categories of obstacles. The first category regards the socio-economic and cultural status of the families. This category includes problems such as "Families' lack of digital devices" which was the most reported obstacle, "the financial inability to connect to the internet" and the "Cultural and social distance between family and school." The second category includes teachers' difficulties in implementing distance education, such as "The Additional difficulties in managing teaching and learning in distance education " and "Difficulties in designing effective distance lessons"

The main challenges, which had to be addressed during the distance education period, can be categorised into the same way. Starting with the socio-economic and cultural status of the families combined with "The inequalities among students" and "The parental role" in distant education are observed as important factors affecting the teaching and learning process. The second category includes teachers' difficulties related to "the assessment reliability", "the model of teaching approach" and "the management of teaching/learning time".

When it comes to benefits derived from distance education, it is worth mentioning the following:

a) Teachers' increased flexibility in the management of resources and activities as well as the development of digital skills.

b) Students' development of 21st century skills, increased students' autonomy in the learning process and, besides, the development of digital skills. Moreover, distance education windowed the opportunity to maintain the socio-psychological bonds between teachers and students remotely.

Alongside, a number of different characteristics have also been identified analyzing the research findings. The most important of them are as follows:

Greek teachers seem to have felt more secure, a little bit happier and a little less disoriented and anxious in comparison to their colleagues in Cyprus and Italy.

Collaborative Learning practices, Differentiated approach, Blended Learning and interdisciplinary approaches are more frequently adopted in Cyprus while Flipped Classroom is more frequently used in Italy whereas project-based learning is the approach followed in Greece.

Regarding the first post-lockdown period, Flipped Classroom is implemented more frequently in Italy while the Interdisciplinary approach is used more frequently in Cyprus.

There are different and conflicting opinions, however, amongst principals about continuing using these innovative methodological approaches. Principals in Greece and Italy state that the increased use of digital applications and teleconferences will be used constantly in the future, whereas Principals of Public schools in Cyprus are rather pessimistic, arguing that teachers will resume teaching practices utilised before the pandemic.

Regarding teachers' remote collaborations, Italian teachers develop co-operations and views exchange with both the students, Principals and Deputy Principals as well as the school supporting team in percentages that are equal to or approximate, respectively, those of

cooperation and views exchange with colleagues from the same school. Cypriot teachers use these resources in about half percentages compared to their Italian colleagues. Greek teachers are about halfway between Italian and Cypriot colleagues.

Cooperating with colleagues from other schools is clearly used more frequently by Greek teachers, perhaps due to the fact that in GreeK schools have a small number of students and teachers and consequently have spatial proximity.

To a relatively small extent, between 10 to 25%, teachers communicated with Educational Advisors and school Inspectors for collaboration and views exchange. This way of communication and cooperation was more frequently by Greek teachers and clearly less frequently by the Italian ones.

Regarding teachers' views on the obstacles

a) Cypriot teachers give the lead to "Difficulties in cooperating with families" and "Additional difficulties in managing teaching and learning in distance education". They also refer to "Cultural or social distance between students and school", "Difficulties in designing effective distance lessons" and of course "Families' lack of digital devices".

c) Italian teachers besides "Families' lack of digital devices" put emphasis on "Additional difficulties in managing teaching and learning in distance education" and to a lesser extent to "Cultural or social distance between students and school".

d) Greek teachers besides "Families' lack of digital devices" focus and on "Cultural or social distance between students and school", "Additional difficulties in managing teaching and learning in distance education", Difficulties in designing effective distance lessons" and to a lesser extent on "Risk of increasing digital divide and inequalities".

e) "Difficulties in cooperating with families" was a minor obstacle for Greek teachers, while it was not an obstacle for the Italian teachers.

Another interesting finding is the fact that the Cypriot teachers found significant difficulties in cooperating with the students' families, while their Italian colleagues considered that there were no obstacles in this cooperation.

In conclusion, despite the problems and the difficulties arising, distance education seems to have brought forth certain positive aspects for all three countries. Teachers developed multifaceted collaborations, exchanged teaching materials, utilised unfamiliar for them digital applications and teaching methodologies, developed their digital skills, maintained a psycho-emotional connection with their students, and finally, successfully met unprecedented challenges. The aforementioned benefits, however, are not adequate enough to stand for face-to-face teaching and learning. Undoubtedly, distance education proved to be a positive and an up-to-date component of teachers' professional development that needs to be further supported and empowered.

1.5. Interviews with principals

In the context of research on distance education in secondary education, structured interviews with school principals were conducted, both as a compulsory practice adopted during the COVID19 period as well as independently as a practice of enriching face to face teaching.[1]

The main views expressed in the Principals interviews are:

During the lockdown period, the way of organizing their work as well as the way of communicating with the teachers changed. Also, in some cases they had to provide stronger emotional support and guidance to some teachers.

Difficulties encountered:

a) A number of teachers needed support:

- About the use of technological equipment and platforms for providing synchronous and asynchronous education.
- On the effective use of distance learning.

The issues of technical support for teachers in Cyprus were managed mainly by IT teachers and in Greece the technical support teams were set up in schools, as well as the Directorates of Education. In particular, there is a comment on the issues of scientific support only from the Greek Directors, who point out the contribution of the Regional Centers for Educational Planning (PE.K.E.S.).

b) Some students and their families had problems such as:

- Access and use of technological equipment.
- Active presence during distance education.

Assistance to students and families with poor socio-economic status seems to have taken place only in Italy, with the contribution of third sector companies.

Communication with parents and guardians was achieved satisfactorily for all three countries, primarily through the use of teleconferencing and secondarily through telephone communication.

Schools, in general, provided the necessary resources and tools through the Ministries of Education, although these resources were not considered sufficient.

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[1] In the interviews, which took place in June 2021, a total of 10 secondary school principals from Greece (4), Italy (3) and Cyprus (3) participated. The issues and the questions addressed can be found in Annex 2.
..

There were differences in the types of digital tools used by each education system. In total, the MS Teams platform in Cyprus, the Webex platform in Greece in combination with the learning management systems of e-class and e-me, and the Google Meet and Zoom platforms in Italy were used.

Principals believe that the lockdown period has also brought benefits to education, especially in terms of strengthening the digital skills of both teachers and Principals. In particular, they mention the MS Teams platform in Cyprus, the Webex platform, the interactive Phet simulations and the Geogebra and H5P applications in Greece, the Google Meet and Zoom platforms as well as the Google Classroom application for Italy.

Finally, they estimate that, after the period of the pandemic, there will be a corresponding enrichment of teaching practices, mainly with the use of digital tools and video conferencing platforms.

1.6.   Focus groups' discussions

In order to explore the impact of emergency distance learning during the period of schools' closure, as well as the limitations and needs arisen during implementation and, especially, the perspective of digital tools' use into face-to-face teaching, focus groups discussions were organised in all three (3) countries. 6-10 teachers (mathematics, physics and foreign languages), parents and students participated and the research techniques are briefly described in the following figure:
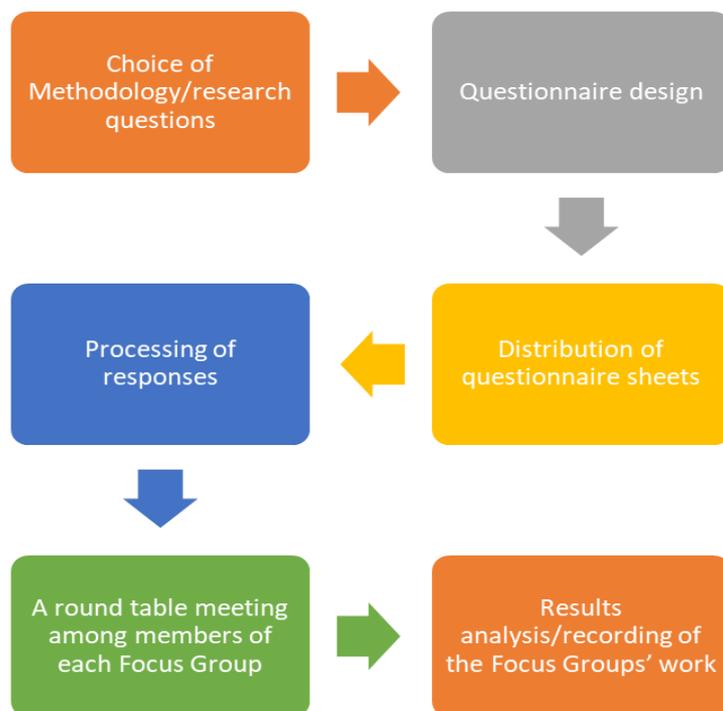
The issues raised for discussion were common to all three (3) countries and focused on the following areas:

- Teaching
- Learning
- Evaluation

These axes emerged after consultation among the project partners, taking into account the special circumstances per partner educational environment, where the distance learning practices were developed. The outline of the discussion was as follows:

Questions for all participants:

- Was distance education important during the pandemic? Give reasons.
- What was the most significant element/aspect during Covid-19 crisis and online classes?
- What did you like most in distance education during the lockdowns (synchronous & asynchronous)?
- To what extent has your role changed in distance learning?
- Which factors should we take into consideration when teaching/learning online?
  School settings / curricular constraints / psychology / cognition and behaviour of students / profile of teachers
  - Teaching
  - Learning
  - Assessing
- What challenges did you face during distance education?
  - Teaching
  - Learning
  - Assessing
- What needs would you like to be covered in the future?
  - Teaching
  - Learning
  - Assessing
- What solutions do you suggest for the challenges faced?
  - Teaching
  - Learning
  - Assessing

For the teachers:

- Were your classes based on a specific methodological design?
  - *If yes, which one? To what level? (task/micro-scenario/macro-scenario)*
  - *If not, why?*

- Did the digital activities serve your students' learning needs?
    - *Were they well-organized? How do you know?*
    - *Did they promote their motivation? How do you know?*

For the students:
- Did the digital activities serve your learning needs?
    - *Were they well-organized? How do you know?*
    - *Did they promote your motivation? How do you know?*

For the teachers (*related to the IO2-Educational Scenarios*):
- Is a teaching scenario more useful in a face-to-face context or in distance mode? Why?
- How can educational scenarios be successfully incorporated in asynchronous distance learning/teaching when face-to-face classes start again (in blended learning contexts)?
- What do you think are the main characteristics of a good Maths, Physics, Foreign Language scenario (each teacher answers for his / her subject)?
    - What should their aims be?
    - How could the best possible interaction with students be ensured?
    - How should learning be assessed?
- Is reflection on "critical teaching events"[2] useful? Give reasons.
- What kind of data/documents do you need to collect to help you reflect on the quality of your teaching practice?

After debriefing of what was discussed, the reflections developed and the suggestions proposed by the focus groups, in what concerns the pedagogical approaches and teaching techniques adopted during the period of face-to-face teaching cease, the following issues emerged:

- Lack of infrastructure both at school level and at individual level to ensure uninterrupted internet access. As the teachers pointed out, a basic obstacle was the insufficient technological infrastructure of the schools but also the lack of technological and internet "resources" in the teachers' premises, since they had to teach simultaneously in "real" time and asynchronously from their homes/residences.

    For the students, the problem of lack of technological equipment was even more acute. The cases of students who attended the lesson via mobile devices were reported, with issues related to their active participation. In addition, lack of available digital resources on networks and platforms which made access difficult in peak

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[2] In relation to the Critical event: Critical events are "*Facts that lead the teacher to wonder what actions or decisions to take in order to be able to improve his teaching* (Goodell, 2006). Also, "*Critical event can be considered a daily incident that faces the teacher during the teaching, which he puts under challenging his teaching decisions* (Lerman, 1994). In other words, a critical event is any event that causes the teacher's attention to reflect.

hours. An added issue as regards the first phase of emergency distance education, is the insufficient preparation of registering students' data in the official school platforms.

- Sudden and unprepared transfer of teaching practices from exclusively face-to-face to exclusively distance learning. The vast majority of teachers have no experience in using digital tools to support their teaching in distance learning environments. Few teachers, for example, maintained a blog where they posted educational material, and even fewer used a distance learning platform to support their classroom teaching. Even those teachers who were familiar with the use and exploitation of digital tools, had almost never been in the process of designing their lesson.

- Inadequate training of teachers in the use and exploitation of digital tools and especially in the implementation of distance education. The lack of teacher training and the delayed response by the central body in charge of such training were replaced mainly through in-school training practices. The latter was supported by the establishment of support committees at school level and the individual training activities implemented at regional level by institutionalised teacher training bodies.

- Problems in managing the syllabus due to the "syllabus-centered" approach and the strict scheduling based on curricula. In the first phase of school closure, the process was more focused communicating with students rather than teaching and learning. What was extremely important was to keep students in touch with the educational process.
In the second phase, however, when it became apparent that the circumstances imposed the transfer to synchronous and asynchronous digital environments, the need of training on digital tools emerged, but mainly on distance learning teaching practices.

- The teachers' burnout was the basic result of the period, since teachers were called upon to transfer all educational processes to digital environments, which required countless working days.The need to support teachers, so that to be resilient in times of crisis, emerged as a primary need immediately after the first month of distance learning.

- Active learning, unlike face-to face teaching, requires participatory processes, interactions and collaboration which, especially for age level of students, cannot be developed in a distance learning environment, mainly the synchronous phase, as so

emphasized by the teachers as well as the students who participated in the focus groups.

- The emancipation and autonomy of students is a prerequisite when the educational process is transferred outside the walls of the classroom and at a distance, which is both physical and psycho-emotional in regards the teacher.

- The crucial role of parents and guardians was highlighted, who were invited, in these circumstances, to take an active role in supporting the learning process, mainly of younger students or students with less maturity readiness.

- The enormous difficulties regarding an effective, reliable evaluation highlighted the need to use alternative forms of evaluation and gave the opportunity to teachers, but also students, to recognise positive types of evaluation which were previously not highly appreciated.
  For example, the assignment of synthetic / research work, individual and / or group work, such as presentations, digital posters, concept maps, audiovisual "texts", virtual representations developed by students was an evaluation practice that "changed" the typical educational "example" and provided students the opportunity to be involved in their own assessment process.
  At the same time, difficulties in remote evaluation and feedback resulted in digital automatic correction tools of evaluation, with multiple functions of self-learning and personalised tools. This was actually an added value in "normal" times and conditions of the educational process.

However, as mentioned by many teachers participating in the focus groups, the use of digital tools was the only way to maintain students' contact with the educational process and to establish a sense of "belonging" to the school community. In addition, almost all participants, teachers, students and parents, agreed that the educational transfer to digital environments can and should be used as a "legacy" for the future, in terms of enriching school teaching through flipped classroom and mixed learning approaches in face-to -face teaching.

The above-mentioned evidence was used to determine the training framework of the CONNECT project, especially in what concerns the design and development of Educational Scenarios, with emphasis on the enrichment of teaching practice through distance education tools and flipped classroom practices.

1.7. Challenges and Opportunities in the Post-COVID world

It is evident that the "closure" of schools has "opened" new perspectives on the use of digital tools per se as well as on their pedagogical use in the educational process. Taking into account that - during the first phase of the sudden schools' closure in spring 2019 - the schools and practising teachers have focused mainly on the digital tools, at the beginning of the school year 2020-2021- during the second phase- greater emphasis has been placed on the pedagogical use of the tools and how these can be effectively implemented as "good practices". In other words, while the teachers' main concern was originally aiming at maintaining contact with students from a distance and sustaining interaction with the "community" members for psychological, emotional, social and pedagogical reasons, during the second phase, a number of issues regarding pedagogy and didactics have emerged: management of school curricula subjects' content, teaching the most significant teaching modules, students' motivation for active engagement, assignments' delivery, assessment of knowledge gained, and evaluation of the learning process in general.

This has resulted in endless hours of training and learning, both formal and informal; practice communities have been developed within and outside schools, additional training courses have been initiated by institutions, informal school community groups have been established on social networks with the aim to exchange feedback on relevant practices. Even educators who were not in fond of digital tools, either because they were not familiar, or trained or had doubts about the digital tools effectiveness, had no alternative but to engage in this reflection process. Integration of technologies, mainly digital distance learning tools, has probably been the most "violent" change that the educational community has experienced in such a short period of time; it is actually a "bottom-up" change based on school practice, teachers' mutual support, in-school training and peer solidarity. Transition from face-to-face to distance learning, though raising serious questions about the potential access of students to distance learning, has raised great expectations regarding its potential in the educational process. It is yet to be seen which distance learning processes are valid for the years to come as well as the extent to which the latter will be integrated in the "face-to-face" teaching. In addition, it is important to see how digital tools will be used in favour of school community interaction "outside the walls" of the school.

2. Pedagogical framework

Introduction

As already mentioned, the COVID-19 pandemic has forced European schools to provide learners with emergency distance education. The school year of 2021-2022 displays new features as educators and learners have come back to class, enriched with new knowledge and skills regarding digital tools' exploitation. This new context highlights the necessity of blended learning as an effective approach in the learning process.

According to the European Commission (2021) blended learning in formal education and training is valid when a school, an educator or a learner uses more than one approach in the learning process; it is a combination of face-to-face teaching with distance learning within school environment but also a combination of different learning tools, both digital and non-digital.

Adopting *the blended learning model,* the Erasmus+ CONNECT project aims at supporting both secondary schools and teacher training systems to respond not only to the current pandemic conditions, but also any future educational challenges. Combining online education with face-to-face interaction is triggering for everyone, including struggling students who need additional guidance and support. It is expected that piloting blended learning - more specifically *the flipped classroom model* - at partner country schools will offer valuable opportunities of exploring teaching and learning practices in the subjects of Mathematics, Physics and Foreign Languages.

In this respect, the Erasmus+ CONNECT project fosters *"the inverted learning with emphasis on hybrid model"* (CONNECT, 2021) aiming at reinforcing the ability of partner country education and training institutions to provide high quality, inclusive digital education. The pedagogical approach is, thus, expected, to provide opportunities for personal, socio-educational and professional development of the target groups involved; using innovative online resources and tools "with the aim of leaving no-one behind" (European Commission, 2020c) will be exploited towards this direction.

2.1. The pedagogical use of digital tools

We live in an era of constant change regarding our world, the society, our students, science and technology, technological-pedagogical needs, schools. In this school of the future, digital

media will undoubtedly be of vital significance and will play a key role in the daily teaching practice, both in terms of transmission of new knowledge and in terms of communication and cooperation between teachers and students as well as among students themselves. Above all, as the experience of education in the period of the pandemic showed, the pedagogical use of technological tools will require the student to act as a "social user" who will need the cultivation and development of multiple skills and literacy in order to operate in these new digital environments successfully.

In the second part of this document the basic principles of pedagogical utilization of technologies in education will be presented, a categorization based on their use and learning added value will be attempted and, finally, some technological tools to be used in Mathematics, Physics and Foreign Language will be proposed.

In this light, the pedagogically oriented use of digital technologies in everyday teaching which promotes the cultivation of multiple literacy and digital skills, should play an important role in the school. According to McLoughlin & Lee (2007), the advantage of using them lies in the social use of the internet, which allows students to work in groups, encourages them to produce material and share it with their classmates, to communicate, collaborate and interact with them. Through interaction, they develop flexibility and problem-solving strategies. A new learning culture is created that is characterized as social learning (Brown 2009, in Papadimitriou & Theofanellis 2016).

In recent years, the effort of teachers of all disciplines to enrich their teaching with multimedia, multimodal and interactive learning content is evident. The rapid development of digital media, mainly the internet, the improvement of technological equipment in schools, the creation of digital educational repositories by educational institutions, the creation of Digital Schools and the digitization of textbooks, the mass training of teachers in the use and utilization of technologies and the "democratization" of the use of "mobile" devices by teachers and students are some of the factors that led a growing number of teachers to enrich the content of their course with online resources, digital presentations, multimedia visualizations, interactive applications etc. More and more often in recent years, teachers use digital learning resources from selected websites in their classroom, as well as digital material that they create themselves using appropriate software and special digital applications.

The use of technological tools should not focus on the simple use of software, nor on their simple integration into the educational process solely as a means of presenting new knowledge. Instead, technology must be utilized with a techno-pedagogical approach that

allows the "utilization" of all these features that we can not find and use if we do not resort to it. In this sense, before using a technological tool we should think about what it offers us in relation to the use of a conventional supervisory teaching tool or textbook. For example, a summary table that shows a grammatical structure on an interactive whiteboard does not add value when it is not accompanied by the use of interactive whiteboard tools, such as the "curtain", "lens", tool "drag" etc. Similarly, showing a video with some mathematical reasoning or some physics experiments or with some sights of a country with a video projector in the classroom offers limited added value compared to using the same video as "interactive" exploiting a digital application that allows the integration of interactive elements such as questions, comments, introduction of hyperlinks, etc.

In addition, before we use any technology during a lesson delivery, we should consider the reasons why we include it in the learning process. Using one digital tool just to talk about "innovation" and "modern" methodological approach is not enough. Its use should be accompanied by the appropriate techno-pedagogical utilization in order to contribute to the involvement of students in the learning process, to lead them to exploration and active involvement, to make them social "users" in authentic digital learning " environments ", to give meaning to what they learn and to what they are called to" do ". And today, more easily than ever, it is possible for students to engage themselves in activities, either individually and/or in groups, where they will use their knowledge creatively. Besides, as teachers, we all know that our students, the same way as we have experienced as students, remember:

- 10% of what they/we read

- 20% of what they hear

- 30% of what they see

- 50% of what they hear and see

- 70% of what they say while talking to others

- 90% of what they say while making something.

Today, more than ever before, educational technologies facilitate the enrichment of course contents with rich authentic and up-to-date material. At the same time, the learning process becomes more attractive for the students, activates them to participate and facilitates the differentiated learning, as, on the one hand, the multimodal texts correspond to all the learning profiles and, on the other hand, the emphasis is on the students' involvement in experiential activities, self-efficacy, autonomy and collaboration in digital environments.

In this context, such an approach to utilizing technological tools, activities such as creating a blog, wiki, a concept map, a word cloud, a digital poster, visualization material, digital storytelling, quizzes, etc., as well as participation in social networks and forums, require students to use digital media, individually and/or in groups, in order to become "creators" of digital material and thus develop multiple skills (communication, digital, social, collaboration, empathy, critical ability, etc.). Digital tools should be used in education and teaching practice, when their use has added pedagogical value, not reproducing traditional practices through contemporary tools. The use of Information and Communication Technologies should not simply focus on the application of software or be limited to a substitute for the traditional teaching board. Instead, technology must be used in such a way as to support the learning process by creating an educational environment, a digital "ecosystem", in which learning events "happen".

Teachers are encouraged to use digital applications in their daily teaching practice to achieve the goals of both concurrent living and cross-curricular teaching. It is suggested that they make use of specific digital educational resources -from the internet- that are pedagogically appropriate for the students and classes' specific needs so that to further support their teaching integrating inverted classroom activities.

The use of digital technologies in the learning process can contribute significantly to the development of knowledge and skills and to the enrichment of teaching with authentic multimodal material. An important element of the pedagogical use of digital tools that should be considered is the gradual transition from "teaching through the media" to "learning through the media". In other words, in the context of experiential, exploratory and active learning, using digital media as a supplementary means of presentation and promotion of new knowledge by the teacher is not enough. What is useful for students is to use them as tools and, above all, as "environments" where the learning process takes place. In this light, emphasis should be placed on the following key ways of using digital tools in educational design:

a) The use of digital technologies by the teacher offers the possibility of exploiting rich and varied multimodal material, e.g. pictures, audio texts, videos, educational games etc. and enriches the activities. Through a variety of digital applications, the teacher has the ability to create attractive worksheets to increase student motivation.

b) The design of activities that promote the use of digital applications by students for the implementation of the activity, the creation of material and/or the presentation of the final

product contributes to the development of digital literacy, the development of students' creativity, as well as their social skills.

In conclusion, through the CONNECT Project, from its material as well as from the suggested educational scenarios, the exploitation of digital technologies in the learning process is promoted. However it is pointed out that they should not be used as an end in themselves. Instead, it is suggested that they be integrated didactically and pedagogically in a way to take advantage of their additional benefits, such as tools for creating a concept map, clouds, digital poster, visualization material, educational games, quizzes, etc.

2.2. Distance Learning Principles/Emergency Remote Teaching Principles

Before the period of the pandemic of Covid-19, the term of distance education concerned a small number of specialised scientists in the corresponding field. The pandemic and the various lockdowns and quarantines forced the educational community to face a number of challenges such as accessibility, insufficient technological equipment, lack of digital skills on the part of teachers as well as the different levels of students' readiness. Yet, it should be noted that European schools have demonstrated a wonderful capacity to innovate and adopt new approaches but also significant shortfalls from a lack of readiness to take advantage of different learning environments and tools. Striving towards a vision of a better-quality and inclusive education is by no means limited to the COVID-19 context, as the ongoing challenges remain.

Vasala (2005) uses the term distance (school) education to refer to primary and secondary education which is remotely provided to school-age students as well as adults.

As regards the basic principles of distance learning, Manousou et al. (2020), in an attempt to respond to the concerns raised by many Greek teachers, have eloquently outlined them as follows:

- Distance learning is a comprehensive training methodology, which, in order to be effective, requires careful planning. It also needs a well-organized administrative system with ongoing support and detailed specifications.
- Appropriately designed distance learning educational material is a basic prerequisite that contributes to its effectiveness further. The distance learning material should be clear and self-explanatory so that it can attract interest, effectively support learners in the learning process, give opportunities for active participation, provide feedback, and contribute to self-evaluation.
- ICT is a tool used to support the distance learning process as such. The emphasis should always be on the educational process and the pedagogical use of ICT in

terms of quality and efficiency. In the context of the overall design, emphasis is placed on the interaction, cooperation and complementarity use of synchronous and asynchronous forms of learning.

- Both asynchronous and synchronous learning should be included in the pedagogical planning of distance education. Asynchronous is directly connected to the educational material while synchronous teaching should serve to support the asynchronous forms of communication.
- In order for distance education to be effective, it must be carried out by teachers specially trained in distance methodology. Familiarity with the methodology of distance and the use of digital tools always aimed at enhancing and enriching the distance learning process is one of the cornerstones of success.
- Accessibility is another crucial factor, as it is important to give everyone the opportunity to participate. Availability of equipment and basic digital skills must be taken into account in the design and overall organization so that everyone can participate.
- Distance school education was developed to address the difficulties and gaps that can not be filled in by conventional education systems and not to replace traditional learning as we know it.
- Distance school education utilizes the technology available but technology does not dictate the implementation of distance education.
- Communication is a very important element of distance education and all stakeholders, e.g. students, teachers, parents, should be actively involved.

There are three basic types of distance education:

a) Autonomous distance education, which refers to integrated education programs that are recognized and are identical to the traditional education system

b) Complementary distance education, which operates in parallel and in addition to the traditional system, and may concern individual courses, school networks, innovative programs, collaborations at local, national and international level, on a common thematic unit etc. (Anastasiadis, 2017), which can not be done in the traditional school and are completed remotely and

c) Combined or mixed distance education (blended learning) that combines features of distance and face-to-face instruction (Miminou, 2012, Vasala, 2005).

The combined or mixed distance education (blended learning) is the core pedagogical approach of this output.

2.3. Blended learning in school practice

Blended learning is a combination of online learning and face-to-face instruction in secondary inclusive education that combines the benefits of classroom learning and e-learning. The importance of blended learning in school education has become more evident during the current COVID-19 crisis, which has posed numerous problems for schools, students, teachers, and education personnel thus revealing the possibilities and challenges of distance learning. The crucial role of school communities has emerged; they are viewed as social cells cultivating a sense of belongingness and safety, a context to develop relationships and a source of support from teachers and peers (European Commission, 2020a).

Experiences from Emergency Remote Teaching across Europe as well as worldwide in spring 2020, and a subsequent dual functioning of schools with a partial re-opening, reflect a combination of face-to-face and distance learning. However, this combination is far from a coherent and flexible approach of blended learning.

The Digital Education Action Plan 2021-2027 outlines the European Commission's vision for high quality, inclusive and accessible digital education in Europe. It is a call to action for stronger cooperation at European level to learn from the COVID-19 pandemic and make education and training systems fit for the digital age. It highlights the potential of technology to facilitate more personalised, flexible and student-centred learning. It seeks to address inequities in education where digital competence, access to appropriate tools, and reliable online connectivity are lacking. It stresses the need for strengthening digital capacity in education and training systems (European Commission, 2021).

The pandemic restrictions have challenged the capacity of school organisations to provide teaching and maintain communication among teachers and students (European Commission, 2021). However, it has to be noted that teachers have become remarkably acquainted with digital education and maintained a close relationship with students. The experience gained through using digital tools during the pandemic is valuable.

The aim of this chapter is to provide the theoretical framework of blended learning, which will serve the design and implementation needs of the CONNECT project (CONNECT proposal, 2021). In particular, the chapter focuses on the need to:

- Explore the pedagogical opportunities and challenges of a realistic blended learning model and identify key considerations that can add to reflection process when blended learning is implemented in school practice.

- Support planning of the CONNECT pilot implementation; it may also inspire long lasting positive change for blended learning in Mathematics, Physics and Foreign Languages, embracing innovative pedagogical approaches including assessment.

- Develop guidelines for the CONNECT project and prompt a review of national school curricula that will enable all learners to benefit from the combination of traditional classroom practices and blended learning.

- Support Project partners in strengthening preparedness and resilience of national education and training systems through the development of well-balanced blended learning approaches.

- Guide teachers and strengthen their skills.

- Facilitate a common approach towards challenges and issues encountered during the pandemic which had an impact in the learning itself.

- Promote a common European understanding of the opportunities created by blending learning, including the improvement of quality, inclusiveness of students in education and professional development of teachers.

- Facilitate exchange of practices, research expertise as well as practical experiences and teaching – learning approaches implemented in class among partners.

- Support initiatives to foster professional development of educators as well as learners' skills reinforcement in blended learning environments and tools.

2.3.1. Distance learning, online learning and blended learning

The traditional classroom model, often referred to as "face-to-face", requires that learners physically come together, typically grouped by age or level, to meet at scheduled times and locations for a fixed duration. Conversely, distance learning is a means of delivering content and instruction to learners separated by time and/or location via correspondence text packages, or, with technology developments, broadcast television, radio or teleconferencing (Vale, Oliver & Clemmer, 2020).

Information and Communication Technology (ICT) development has revealed a great number of opportunities and challenges in the pedagogical process and instructional planning. In addition, the integration of digital tools into the school environment has been gradually expanding, thus further supporting teaching and learning and allowing access to excellent education in many school subjects from anywhere and anytime on the internet (Hrastinski, 2019; Taghizadeh & Yourdshahi, 2019). Distance education is defined as: institution-based, formal education where the learning group is separated, and where interactive telecommunications systems are used to connect learners, resources, and instructors (Simonson, Smaldino, Albright & Zvacek, 2012). In the digital era, both synchronous and asynchronous learning are linked with e-learning. The term e-learning was

introduced in the 1980s when online and distance learning showed up (Asif, Edirisingha, Ali & Shehzad, 2020). However, the term e-learning is wider than distance learning (Moore, Dickson-Deane & Galyen, 2011). E-learning aids learners to access the course content even when away from school. At the same time, face-to-face interaction in the classroom setting provides learners with opportunities for strengthening personal interaction with their teacher or peers. This approach of blended learning occurs by the judicious combination of multimedia mediated online and offline instruction as well as the traditional face to face instruction (Doom, 2016; Hui, 2016).

Gradually, online delivery of distance education has become a more popular option for the majority of secondary schools. In the last decades, the Internet has provided various methods which incorporate technology, allowing students and teachers to interact either at the same time or at different times and/or places. The factors of time and place have been organised into Coldeway's Quadrants (Vale, Oliver & Clemmer, 2020) as depicted in Figure 1.
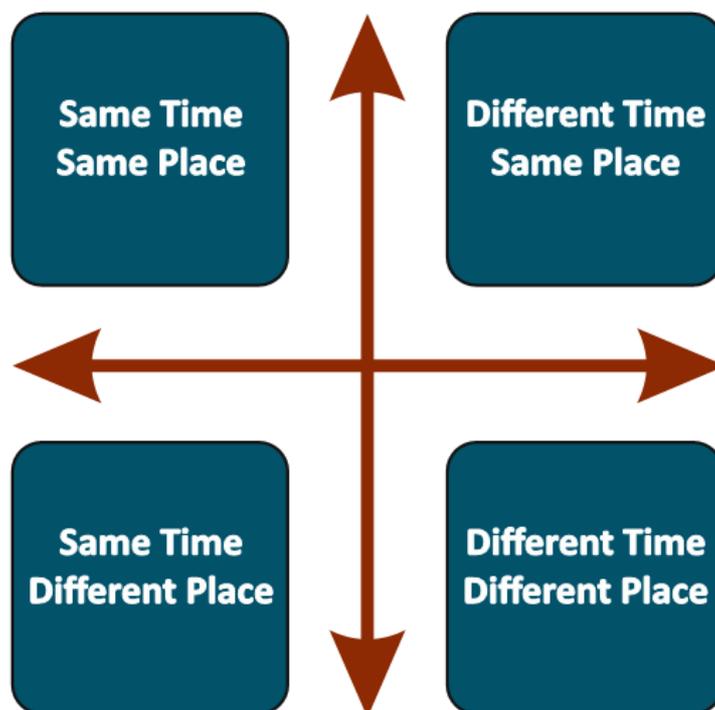
Figure 1: Coldeway's Quadrants illustrating combinations of Time and Place of Learning

The blended learning model may be of two types: homochronous (simultaneous) interaction and heterochronous (at different time) interaction. The quadrants on the left side refer to synchronous distance education whereas those on the right side refer to asynchronous distance education. In this chapter we shall explore the significance of both synchronous and

asynchronous distance learning and the balanced integration of both modes leading to effective learning in the light of a blended learning approach.

Synchronous learning

Synchronous education is an educational communication mode where learner(s) and instructor(s) are in the same place, at the same time, in order for learning to take place. The conventional form of teaching and learning method is synchronous when teacher and learners interact within the same time and place. On the other hand, in synchronous distance education, the learners and the teacher are physically separate only in terms of place, not time; the instruction and communication are provided through technological tools. Blended synchronous learning integrates online and face-to-face instruction to create learning environments where students can attend in-person or from a distance simultaneously (Angelone, Warner & Zydney, 2020). E-learning often takes place via a teleconference or video conference over a high-speed web network, where the teacher and the learners can interact within the same time but not the same place. In the modern digital era, the examples of synchronous learning are one-to-one tutorials or even online seminars, often called webinars.

The online learning environment in the real classroom gives opportunities to interact in face-to-face situations and is mostly called synchronous learning (Simonson et al., 2012). Synchronous lectures, discussions and lesson presentations occur at a specific position in time with the anticipation that all learners will be actually participating. Distance synchronous teaching put forward learners and teacher facilitators providing numerous means of interaction, of sharing, giving the chance to work in partnership and raise questions in real-time through modern technologies. Examples of synchronous online educational technologies comprise videoconferencing, webcasts, interactive learning models, and teleconferences, chatting etc. (Sana, Adhikary & Chattopadhyay, 2018).

Asynchronous learning

Asynchronous distance education (or online learning) refers to the separation of teacher and learner both in place and time as there is no real-time communication between them. The teacher usually shares the course contents such as videos and texts with the students, who can access these contents at their own time and learn at their own pace by doing unlimited repetitions of the course content (Jiang, 2017).

It is a learner-centred teaching-learning process in which online resources are used to share information among a group of networked people. This approach puts together self-study and asynchronous peer-to-peer interactions. The teacher communicates with students through a given platform, such as discussion forums and e-mail. While the students take responsibility

for their own learning, the teacher can provide them with educational support during this process. The teacher may also give students assignments. Students may also upload assignments on the platform.

Learners have the opportunity to actively engage in their own learning in an asynchronous learning environment and spontaneously interact with their fellow learners or peers, provide peer responses, and demonstrate their learning outcomes (Simonson et al., 2012). Different learning environments require different learning activities and expectations that necessitate learners to construct, synthesise, explain, and apply the content knowledge or skills in daily life (Simonson et al., 2012). Students have the opportunity to reflect on the concepts and facts of the lesson and to learn flexibly (Burns, Holford & Andronicos, 2020). Asynchronous online learning promotes students' collaboration, and learner-to-learner interactions through blogging, email, chat, voice thread, discussion groups, peer discussions etc. (Sana et al., 2018).

Among the shortcomings of asynchronous online education are the following: lack of real-time and face-to-face interaction can make students feel isolated with limited commitment to online classes (Jiang, 2017); absence of a classroom environment, or technical support, decreased motivation and less interest in the lesson (Nandi, Hamilton & Harland, 2012).

2.3.2. Blended Learning in secondary education: definition and models

The blended learning approach, is defined as an education programme or course that merges face-to-face instruction and online-mediated instruction with the support of emerging technologies and, especially the Internet (Horn & Staker, 2014; Stein & Graham, 2014). According to the European Commission (2020a, p. 4), blended learning is understood "*as a hybrid approach that combines learning in school with distance learning, including online learning*". In the European Commission Council recommendation, it has recently been stated:

> *Blended learning in formal education and training happens when a school, educator or learner takes more than one approach to the learning process: blending school site and distance learning environments; and blending different tools for learning that can be digital (including online) and non-digital as part of learning tasks* (European Commission, 2021, p. 4)*.*

Blended learning is one of the learning methods that combine face-to-face conventional classroom strategies with online learning that uses digital media. Mixing internet technology and traditional pedagogies in schools and universities has enhanced teaching and learning development since 2000 (Thorne, 2003). Blended, or hybrid, courses are increasingly being adopted in many secondary schools around the world and have often been disseminated as the ideal way to facilitate learning since they allow learners to interact in both face-to-face

and online settings, thereby experiencing the "best of both worlds" (Hew & Cheung, 2014). It is used as a means of education at all levels in European Union schools. This affects the learning opportunities of a larger and more diverse population far beyond time and geographic boundaries (Alam & Agarwal, 2020).

Nowadays, blended learning can be implemented with the help of many different types of applications such as Moodle. The integration of Moodle, a free open-source Learning Management System (LMS), is preferred by many teachers in educational institutions throughout Europe. Moodle which is a virtual e-learning tool, is a learning platform used to augment and move existing learning environments online. Moodle application, developed on pedagogical principles, is used for blended learning, distance education, flipped classroom and other e-learning projects in schools by educators and trainers aiming to achieve learning goals.

Most blended-learning programs resemble one of the five models: Face-to-Face Driver Model, Rotation, Flex, Self-Blend Model and Online Driver (Enriched Virtual). The Rotation model includes four sub-models: Station Rotation, Lab Rotation, Flipped Classroom, and Individual Rotation, as shown in Figure 2 (Sana et al., 2018).
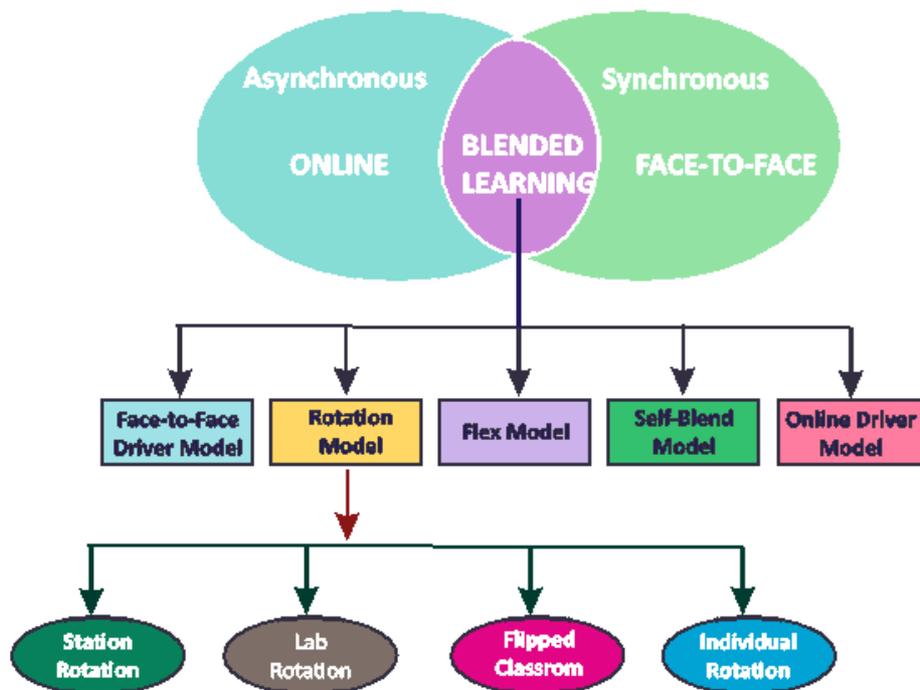

Figure 2: Schematic illustration of blended learning (Sana et al., 2018, p. 36)

Blended learning can be effectively implemented in mainstream secondary education. It is a flexible model that can support a course of study to progress whilst not requiring teachers and learners to be always in the same physical space. On a practical level, this is useful for

times when attending school is not possible, or when other sites are more appropriate for the learning process.

It should be noted that instructional decisions for the embedding of blended learning have to be based on what is the best for the learner while pedagogical approaches and actions should be carefully planned, created and monitored with feedback.

> *To ensure an optimal use of blended learning, teachers and students must be equipped with the necessary knowledge, skills and attitudes, and be receptive to using appropriate digital tools and to changes in teaching. The blended learning approach also needs to be sufficiently flexible to allow adaptation to learners' needs and freedom for educators to adopt it according to their context and audience. Providing conditions conducive to blended learning also depends upon the learners' resources and the school's organisation, culture and resources, i.e., access to appropriate, affordable and well-functioning environments and tools* (European Commission, 2021, p. 4).

Its various components help the provision of new knowledge and skills of students influencing their outcomes and achieving the desired improvement in schools.

Blended learning is not merely combining virtual with shared face-to-face classes; it is a teaching and learning process integrating various factors: learning environments (home, internet, school, workplace), competence development process (lifelong learning and professional development), affective domain (motivation, satisfaction, discouragement, frustration) and people (learners, teachers, parents, other staff). For this reason, it is important to consider blended learning within the ongoing development of the whole school and all its associated stakeholders. The concept of "schools as learning organisations" is another useful frame of reference that can help schools plan for and manage innovation and change.

The most important challenge or issue related to blended learning is the question of how we mix the face-to-face and online learning components. Central is the conviction that it is the pedagogy or instructional strategy used which determines whether learning takes place rather than the mere physical characteristics of the medium. However, although the physical characteristics of the learning environments (online or face-to-face) are not causal factors, they can enable or constrain pedagogical models (Graham, 2013; Hew & Cheung, 2014).

Blended learning fosters a learning process that extends both before and after a structured learning event, or "lesson". It potentially reduces teacher- student knowledge transfer being a dominant feature and establishes the "before" and "after" stages as more meaningful to the learner.
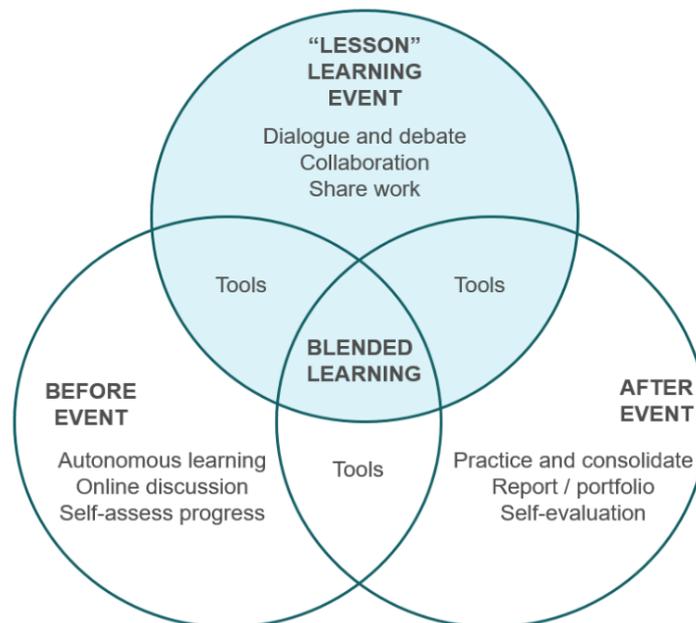
Figure 3: Blended learning as a process including before and after learning events
(European Commission, 2020a, p. 7)

For learners who are more independent, specific time (hours, days, and weeks) can be devoted to distance-learning, where the role of the teacher is to provide support, feedback and instruction on a needs' basis while students work through course curriculum and content. This gives students a high degree of control over their learning and supports their self-directed and goal-oriented learning. The latter may include taking elective courses provided by other schools, or internships in the workplace that are of particular interest to the student and can be included in a flexible "a la carte" schedule (European Commission, 2020a).

2.3.3. Benefits of blending learning for students

According to Horn and Staker's definition (2014), blended learning is a formal learning path in which a student learns at least through online delivery and time, place, route, instruction as well as at least one supervised brick - and stays away from home. In order to provide an integrated learning experience, each course or subject is linked to each student's learning path.

A blended learning approach acknowledges the value of school in itself as a shared space for personal and social interaction, which itself is important for learning as a way of understanding and making meaning of the world.

> *A blended learning approach can enhance broad competence development, due to the variety of learning tasks and tools it can encompass. The use of digital technology, including connecting devices online, can facilitate the interaction of the learner with other learners,*

*learning programmes, and other sources of information, and can support learning in different environments (*European Commission, 2021, p. 11).

Blended learning is used as a way to support learners' autonomy, address personalised learning needs and develop personal, social and "learning to learn" competences.

On the one hand, synchronous learning has many benefits. When students watch a lecture together in a classroom, they are engaged in synchronous learning mode. All learners participate in the learning process in the same group and at the same time. They can raise questions in real-time, experience a sense of community when they all learn together, become motivated and actively engaged in their learning and, finally, develop a strong feeling of collaboration. On the other hand, asynchronous learning provides a variety of multimedia tools and online learning resources, which can help learners develop interactive communication. In this setting, they can monitor their learning progress when they want, where they want, at the pace they want, in the order they want. They have more time to repeat what they learned (Sana et al., 2018).

Blended learning is an innovative method for students, making learning and teaching more comfortable and more attractive in accordance with 21st century skills. Learners can learn easily through this method because it is supported by the theory of experiential learning (Seaman et al. 2017; Teclehaimanot & Lamb 2005; Wetzel, Buss, Foulger, & Lindsey, 2014). Osguthorpe and Graham (2003) support that blended learning focuses on students' needs, improving flexibility and critical thinking skills.

Willging and Johnson (2009) note that the main factor influencing online courses is learner satisfaction, which is the amount of learner's attitude and feelings about all advantages of blended learning classrooms (Woltering, Herrler, Spitzer & Spreckelsen, 2009; Wu et al., 2010). According to Chang and Fisher (2003), learner satisfaction is the main factor that can influence the success and failure of using new methods of teaching and learning and is an essential factor for implementing blended learning. Learner satisfaction is found to motivate, engage, and influence the learning, efficiency, and the achievement of learners.

There is abundant evidence to show that using blended e-learning improves students' motivation and achievements and helps to create fun learning (Smith & Kurthen, 2006; Wong, Hwang, Choo Goh & Mohd Arrif, 2018). Blended learning can improve students' engagement in learning; it also helps students achieve a meaningful level of learning (Innes & Wilton, 2018). That is because blended learning entails social interactions, technology quality, and face to face support (Tawil, 2018). Therefore, blended learning can complement a conventional teaching and learning process that lasts only a few hours in school. Some of the most promising recent technology-related teaching tools illustrate that teaching and learning processes become more flexible and innovative and at the same time attract learners to be interested in the presented lessons (Taghizadeh & Hajhosseini, 2019; Wong, Hwang, Choo Goh & Mohd Arrif, 2018).

It should be noted, though, that students suffer from self-regulation challenges and inability to effectively use technology for studying; teachers' main challenge is their unwillingness and negative perception of using technology for instruction; in addition, educational institutions find it difficult to provide the proper and sufficient technological infrastructure, as well as effective teacher training support (Koç, Liu, Wachira, 2015; Rasheed, Kamsin & Abdullah, 2020).

2.3.4. Challenges of blending learning for teachers

Blended learning is a combination of face-to-face and learning using technology, which can enhance student-centred form of learning, help learners interact more freely, and increase time management (Graham, 2013).

Blended learning supports maintaining students' interest because of efficient interaction between students and teachers, through a variety of accessible technical resources, integrating various modalities for content delivery (Dwyer, 2016). Blended learning also assists in assessing individualised assignments (Hudson, 2013). The use of the blended learning approach is very challenging for teachers who are still following traditional and teacher-centred approaches (Chen & Jones, 2007; Nwachukwu, 2015)

Teachers can create a blended learning environment by employing various online instructional models in the face-to-face classroom environment as well as away from school. The litheness and handiness of blended learning provide the teachers an opportunity to develop different paths of interactive and collaborative learning. The blended learning course generates a strong relation of interaction and feedback between students and teachers (Ginns & Ellis, 2007; Roschelle et al., 2010).

Teachers have a significant role in online classes, as they can provide instructional content and prepare the learning environment for learners in blended courses. To simplify the learning process, online instructors can use some methods, such as reviewing learners' posts, completing the course activities, and giving reflective educational feedback (Garrison et al. 2010). It is argued that knowing different instructional approaches, methods, activities, and theories is more essential for teaching in a blended learning environment than in a face-to-face one (Dereshiwsky, 2013; Sadera et al., 2014).

Teachers need to improve their abilities in blended learning approaches and in teaching practices to increase the performance of students through engaging them in various learning activities (Lam, 2015). It is suggested that curriculum development experts, teacher trainers and education policymakers include blended learning courses in the Teacher Training Programs especially for Mathematics, Science, and Language subjects at secondary school level. These training courses need to comprise both online and face-to face classroom activities.

Concludingly, from the aforementioned arguments as well as the existing literature, it has become evident that during the post-Covid period blended learning can improve the quality of learner-teacher interactions, promote increased learner involvement, and improve learning outcomes. Synchronous and asynchronous learning involve two distinct pathways or modes of learning. The conventional face-to-face instruction is always through synchronous mode in a physical classroom representing traditional classroom learning while asynchronous learning evolved through multimedia and technology tools of distance learning.

There are strengths, challenges and limitations to this model. Some learners prefer a synchronous face-to-face learning mode because they prefer face-to-face instruction through traditional classroom teaching. For other learners, asynchronous distance learning settings provide more time to consider other aspects of learning. To minimize weaknesses and to strengthen benefits, both learning styles should be judiciously and thoughtfully integrated and utilized to support learner needs within blended learning.

In the light of the discussion above, blended learning has proven to be a highly successful model in various cases of integration in secondary education. Traditional teaching has to be adjusted according to the needs of the new "digitally literate" students (Chen & Jones, 2007). Incorporating technology in face-to-face teaching may bring insights into the new advancements in the learning process. The combination of face-to-face instruction and blended learning can provide better collaborative learning experiences. Additionally, it is advantageous for both teachers and students to actively participate in the process of blended learning, thus resulting in achieving better outcomes in their work and empowering them digitally.

In the current conditions -following the pandemic era- the best way of using blended learning in an efficient learning programme is their judicious and thoughtful integration through the combination of the conventional classroom instruction with asynchronous distance learning. Synchronous courses in the real classroom can be supported by the asynchronous multimedia mediated web-based resource materials, interactive tutorials, quizzes and assignments, projects that can be completed or submitted online. Creating such a blended learning programme which combines an effective set of synchronous instructional classroom activities with asynchronous supporting material that provides strong support and flexibility to the learner is challenging. Yet, it facilitates learning with a range of in-class and outside class environments, tools and tasks; in other words, it seems that the best way to perform the efficient academic achievements is through providing learners with access to the internet and ICT.

While blended learning courses have the potential to integrate the most beneficial aspects of each learning path, such course design in secondary education requires diligence to successfully find a balance and ensure the optimal delivery mode. A well-designed blended learning course allows students to experience the benefits of both face-to-face and online instruction and uses each type for its strengths. The advantages of both types of instruction include direct contact, real-time interaction, time for conscious reflection on discussion

responses and the ability to share sources and resources. In practice, this ideal blended learning approach is far more difficult to implement.

2.4. The Flipped Classroom approach via technology

The purpose of this section is to define and describe the Flipped Classroom approach, present its basic educational principles and outline potential implementation in secondary education school practice. This chapter also provides a detailed literature and research review with evidence-based implications for secondary education practice.

The flipped classroom approach has been used for years in various disciplines in higher education, although recent efforts to define and promote this practice have led to increased awareness and dedicated research. The flipped classroom approach does not comprise a single model, but rather a core idea to flip the lecture-based classroom instruction and utilize pre-recorded videos and reading assignments in advance of class. Following, class time is used to engage learners in problem-based, collaborative learning and advancing concepts. Most importantly, the learner has control of the pace and time it takes to learn the material (Hsieh, 2017).

The flipped classroom is a model of blended learning. It is an innovative teaching and learning method, which will definitely play an important role in the field of future education. The flipped classroom model combines converging trends: A shift of emphasis in educational philosophy from guidance to active learning and the rapid development of technology by providing tools for active learning. The flipped classroom model transforms the educational process from teacher-centred to student-centred.

Flipping the classroom emerges as a unique approach to improving learner retention In order to make efficient use of class time. Focus is placed on flipping aspects which refer to the instructional planning. Specific strategies and tools are mentioned for flipping using a three-stage framework for instructional design that involves learning in both synchronous and asynchronous learning environments (Hsieh, 2017). Basic procedures and tools are provided to secondary education teachers, which are used to analyse, design, develop, implement, and evaluate a flipped learning experience (Estes, Ingram & Liu, 2014).

Under the flipped classroom approach, the teacher takes on a variety of roles, amongst others a subject matter expert, an instructional designer, or a media developer. For example, teachers collect data before, during, and after face-to-face instruction, informing the teaching planning. They transfer didactic instruction to an asynchronous distance learning environment, often using technologies and incorporating tools and lesson plans for active learning during face-to-face instruction to help scaffold deep learning during class time. On the other hand, the role of students in the flipped classroom is using active learning methods to critically reconsider resources outside class, and then apply what was learned in a collaborative class environment.

The flipping promises to help students achieve meaningful learning outcomes as well as help teachers make more efficient use of class time. The role of the teacher is, therefore, redefined as they must contribute to the formation of a school climate that will promote cooperation, student self-action, critical thinking and mental readiness. Teachers who evaluate and select the aforementioned instructional design approach must make important decisions regarding content sequencing and flexible formatting for access and subject delivery both inside and outside scheduled class time.

2.4.1.   Defining Flipped Classroom

The terms Flipped Classroom and Flipped Learning are used to describe a new approach to educational planning (design) in schools. As one of the current influential models of instruction, the 'flipped classroom' has encouraged students to engage in learners-based education activities. While often defined simplistically as "school work at home and home work at school," Flipped Learning is an approach that allows teachers to implement a methodology, or various methodologies, in their classrooms. The main idea behind it was that class time previously used for boring lectures could be substituted with classroom activities benefiting students' deeper exploration of learning materials and content (Walker, Tan, Klimplová & Bicen, 2020).

The Flipped Classroom model refers to an educational approach, in which students watch educational videos at home and homework assignments are done in class. Over the last decade Flipped Classroom has evolved in many ways and at many levels (Walker et al., 2020). The concept has attracted huge attention all over the world and has become one of the current trends in education, while several empirical studies have already been conducted (Akçayır & Akçayır, 2018; Bishop &Verleger, 2013; Giannakos, Krogstie & Chrisochoides, 2014; Hultén & Larsson, 2018; Lo & Hew, 2017a; Wagner, Gegenfurtner & Urhahne, 2021).

The term "flipped classroom" came from "inverted classroom", which was first coined by Lage, Platt, and Treglia (2000) in the context of higher education, who provided the following definition: "*Inverting the classroom means that events that have traditionally taken place inside the classroom now take place outside the classroom and vice versa*" (p. 32). Based on this, Bishop and Verleger (2013) elaborated on a definition of the flipped classroom as an educational method that consists of two parts: interactive learning activities inside the classroom, and autonomous online instruction outside the classroom. It is worth mentioning that, in contrast to Lage et al. (2000), Bishop and Verleger (2013) stress the importance of the modern student-centred educational approaches and the use of digital technology in the instructional activities outside the classroom. Student-centred educational approaches are widely practised in education, a result of empirical evidence proving they are much more effective than the traditional teacher-centred instructional approaches, in which students are passive participants in the educational process. In addition, the traditional class time and

self-study activities are temporally and spatially inverted. Contemporary educators, who believe in social collaborative and cooperative teaching methods, i. e. inverted classroom, peer instruction, and reversed learning, often apply the flipped classroom, as a student-centred educational approach (Bishop & Verleger, 2013). Initially, the method was implemented at universities, but it was soon extended in secondary education and then, across disciplines and contexts, educators are experimenting with the flipped classroom approach (Herreid & Schiller, 2013; Hultén & Larsson, 2018).

The current approach of the flipped classroom is commonly attributed to two Chemistry high school teachers in Colorado, Jonathan Bergmann and Aaron Sams, who are considered pioneers in promoting the "flipped classroom" model for secondary education. They, firstly, videotaped their teaching and sent them to the students who were absent, using basic video recording software that added voice-over and annotation of PowerPoint slideshow presentations accessed through electronic and online media. Bergmann and Sams first initialised this method as the pre-vodcasting model: "pre" because viewing the video occurred prior to class and 'vodcasting' as an acronym for video podcasting. Class response was very positive whereas the videos were also viewed by students who were in class but desired to watch at home. Afterwards, the videos were shared before classroom teaching and as a result teaching started to change. Following professional guidance to other teachers, the aforementioned scientists changed the term to *reverse instruction* to address the fear teachers expressed because of the technology-driven framework. Their book "*Flip Your Classroom: Reach Every Student in Every Class Every Day*" (Bergmann & Sams, 2012) constitutes the first guide to this pedagogical model. It starts with the remark that students need teachers in case of difficulties or questioning rather than simply attend a series of lectures given by them. As such, they "inverted" the classroom in fact observing better learning outcomes for students. An in-depth definition is:

> *Flipped Learning is a pedagogical approach in which direct instruction moves from the group learning space to the individual learning space, and the resulting group space is transformed into a dynamic, interactive learning environment where the educator guides students as they apply concepts and engage creatively in the subject matter* (Flipped Learning Network, 2014, p.

Specific examples from flipped classrooms indicate that direct instruction usually takes the form of videos that are reviewed outside class followed by traditional "homework" that is completed during class time In the presence of the teacher. However, it is important to clarify that the definition does not require such an approach. Moran and Milsom (2015) expand on the Flipped Learning Network's definition by stating that:

> *Although there is no one model to the flipped classroom, the Flipped Learning Network (2014) described a few key characteristics of flipped learning. First, instructors must be selective in what they require the students to learn on their own and what is best processed within the classroom through active learning strategies. Another characteristic is a shift from a culture that is teacher centered to one that is student centered. In essence, the instructor is focused on best meeting the needs of each individual student. A final characteristic is the importance of a*

flexible environment that allows instructors to address various student learning styles (Moran & Milsom, 2015, p. 33).

In 2018, Bergmann founded the non-profit Academy of Active Learning Arts and Sciences and organized the Flipped Learning Global Initiative (FLGI), a worldwide coalition of educators, researchers, technologists, professional development providers and education leaders in forty-nine countries who are committed to effectively reaching every student every day through Flipped Learning. Since then, the Flipped Classroom model attracts more and more supporters and is applied not only in school and university education, but in adult education as well.

> The Flipped Learning Global Initiative (2018) defined flipped learning as: "*Flipped Learning is a framework that enables educators to reach every student. The Flipped approach inverts the traditional classroom model by introducing course concepts before class, allowing educators to use class time to guide each student through active, practical, innovative applications of the course principles". (*Flipped Learning Global Initiative).

The terms Flipped Classroom and Flipped Learning are used to describe the same concept. In the present work, nevertheless, we prefer to use the term Flipped Classroom.

2.4.2. The characteristics of the Flipped Classroom

The flipped classroom is predominantly an instructional strategy which spotlights the existence of four pillars : (1) switching the class from spending time for mere lectures to using face-to-face time for various active learning modes, (2) switching the learning culture from a teacher-oriented to a learner-oriented model, (3) switching the role of teachers from primarily outspoken lecturers to professional learning facilitators, and (4) switching the role of students from passive sponges to autonomous pioneers (Chen, Wang, Kinshuk & Chen, 2014).

Based on the main concept that learning is a sociocultural process, the flipped classroom instructional pedagogy is likely to represent one of the most beneficial strategies to foster students' active learning, autonomy and self-motivation Additionally, it offers various opportunities, such as encouraging students to work with their peers and stimulating students to apply course content combined with appropriate technology devices to tackle problems (Zainuddin & Halili, 2016). Many teachers may already flip their classes by having students read content rich texts outside class, watch supplementary videos, or solve additional problems; however, in order for teachers to engage in Flipped Classroom model, they should incorporate the following four pillars in their practice (Flipped Learning Network, 2013 and 2014).

Figure 4: Four pillars of flipped classroom (Flipped Learning Network, 2013)

F: Flexible Environment. Educators create flexible spaces where students choose when and where they learn. Additionally, educators who flip their classes are flexible in their expectations of student timelines for learning and in their assessments of student learning.

L: Learning Culture. In a Flipped Learning model, in-class time is dedicated to exploring topics in greater depth and creating rich learning opportunities. As a result, students are actively involved in knowledge construction as they participate in and evaluate their learning in a manner that is personally meaningful.

I: Intentional Content. Flipped Learning Educators determine what they need to teach and what materials students should handle on their own. Educators use Intentional Content to maximise classroom time in order to adopt methods of student-centred, active learning strategies, depending on grade level and subject matter.

P: Professional Educator. The role of a Professional Educator is even more important, and often more demanding, in a Flipped Classroom than in a traditional setting. During class time, they have to observe students, providing them with instant feedback and an assessment of their work. While Professional Educators take on less visibly prominent roles in a flipped classroom, they remain the essential part that enables Flipped Learning to occur successfully.

While the Flipped Learning model may not work for every class, the model represents an innovative approach to teaching with the potential to create active, engaged and learning-centred classrooms. The four suggested pillars support educators to successfully implement a Flipped Learning model (Flipped Learning Network, 2014).

## 2.4.3. Flipping Secondary Schools' Practices

Whether instructional practice is based on cognitivist or constructivist theories, dynamic classrooms integrate instructional practices as follows: (a) Establish clear learning

objectives, (b) Choose and chunk appropriate course material and (c) Support learning with scaffolding and interaction (Hsieh, 2017).

After establishing clear learning objectives and chunking course into smaller "bite-sized" pieces appropriately, it is important to provide supported learning with scaffolding and interaction, a consistent cognitivist and constructivist learning approach to introduce complex topics, according to the Zone of Proximal Development, namely multiple learning and understanding opportunities that move from simple to more complex (Vygotsky, 1978). This type of interactive environment does not only support teaching but also scaffolds the learning skill (Hui, 2016).

While students' weak motivation may be a challenge in designing the fully flipped course, design benefits include consistency of format, sequence instruction, expectations, and deeper learning opportunities for students. There are several instructional design models (Carr-Chellman, 2015; Gagné, Briggs, & Wager, 1992; Morrison, Ross, Kalman & Kemp 2011; Reiser & Dick, 1996; Seels & Glasgow, 1998) which provide cohesive and consistent instructional design frameworks that integrate technology which is proven useful for flipped instruction.

As it is more commonly known in a Flipped Classroom, secondary students acquire preliminary knowledge at home or remotely via books, videos or online activities whilst teachers use in-school lesson time to facilitate implementation- in class and in practice- of what learners have already been familiarised with. This approach takes into account that all students have adequate opportunities to develop knowledge and skills in both "environments". The main feature of Flipped Classroom is that the distance learning happens before the on-site implementation (European Commission, 2020a).
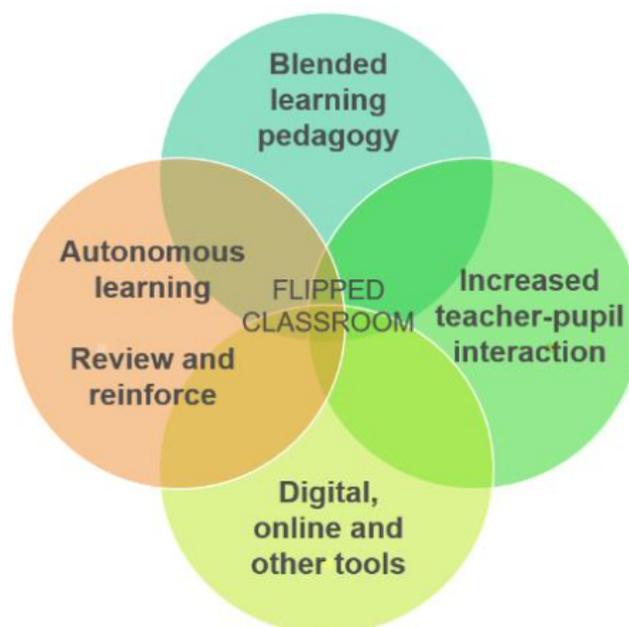
Figure 5: Elements of a flipped classroom approach (European Commission, 2020a)

The principles of the flipped classroom are not new; many teachers have already implemented a variety of educational methods to address learners' needs. It is worth clarifying, however, that the strategy used to reach all learners is important. The teacher carefully selects and uses flexible features of learning environments in order to design teaching according to the diverse learner needs. The teacher distinguishes between lower-level and higher-level cognitive skills and makes decisions about what to deliver, and how to deliver it in a way that maximises class time and leads to deep, meaningful learning (Estes et al., 2014).

Bloom's Taxonomy of the Cognitive Domain (Anderson, Krathwohl, & Bloom, 2001) is a useful framework for determining which thinking skills to teach online and which to teach in-person in a flipped classroom environment. Based on Bloom's Taxonomy, when applying the Flipped Classroom model, the lower levels - Knowledge, Understanding, and Application - are achieved mainly at home, where students can study at their own pace. The higher levels, -Analysis, Evaluation, and Creation- are achieved in the school where the students have the support of the teacher and their classmates (Gariou-Papalexiou, Papadakis, Manousou & Georgiadou, 2017).
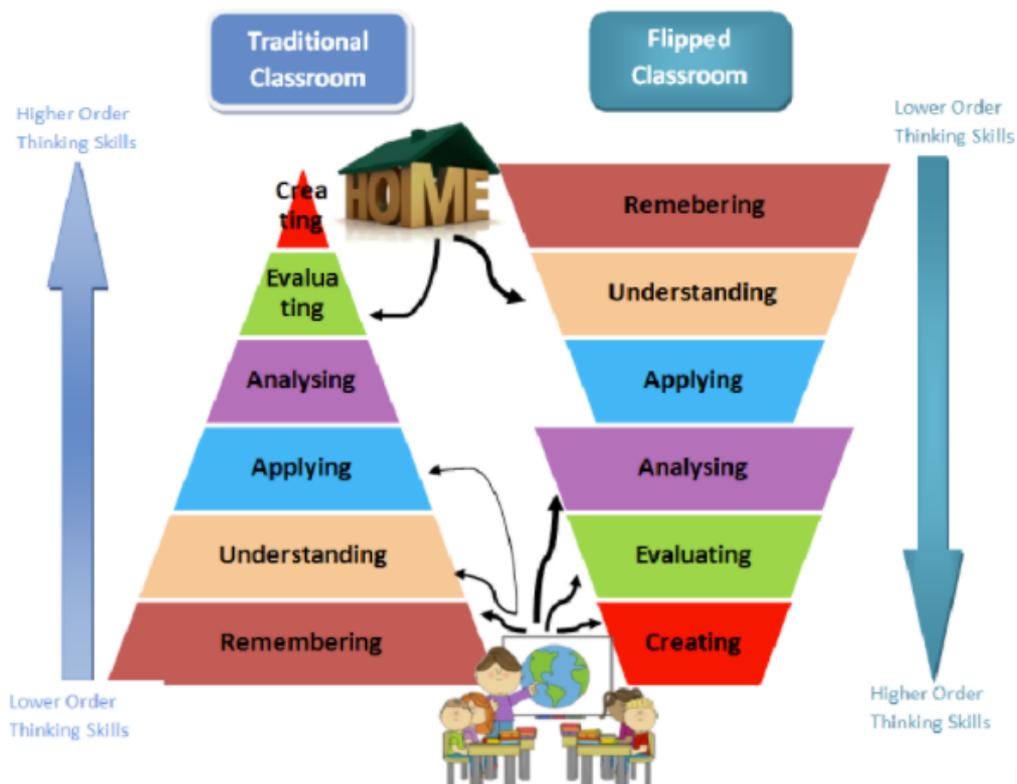
Figure 6: Improving learning to thing a flipping class (Gariou-Papalexiou et al., 2017)

In this light, one might reasonably expect students to be able to learn, recall, and comprehend the curriculum subject at a basic level online; then, use higher order thinking skills to apply, analyse, evaluate, and create new material in the synchronous classroom. Fagen, Crouch, and Mazur (2002) propose that the stand out students become peer tutors

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or 'learning buddies' for their classmates, helping with basic skills that may still require attention during class time.

Students seem to prefer the flipped classroom approach, as long as online preparation and the level of in-class performance are not considered demanding. Meanwhile, teachers have to balance needs and perceptions in order to help students reach their full potential. This learner-centred approach where the teacher is a subject matter expert, an instructional designer, and a facilitator, imposes the active learning role on the student. Students in the flipped classroom are expected to show initiative, to be proactive, to inquire, collaborate, and contribute to new knowledge (Estes et al., 2014).

Because not all students can succeed in learner-centred environments and may feel that "flipped learning is just self- learning", teachers should orient students with learner-centred approaches to make teaching transparent by clearly explaining the pedagogical purpose and to respond to learner strengths and weaknesses as they are revealed (Morrison et al., 2011). Together, the teacher and the students in a flipped classroom are committed to being active participants, who make the most efficient use of time together in class. This cooperative and proactive relationship creates a dynamic and rich learning context that bridges the online and offline experience.

Optimal instructional plans support teaching and learning in a flipped environment. The use of widely available resources can help one redesign not only the delivery of the method but also the sequence of the learning content, the interactions between the learner and the learning content, between the student and the teacher, and among students as well as the means by which learning and transfer in-class and in online environments are assessed. Each one should be designed through careful planning (Driscoll, 2005; Gustafson & Branch, 2002).

2.4.4. Instructional phases in the flipped classroom model

Since flipped classrooms are intended for more in-depth and collaborative learner-content interaction, knowledge construction can be an important learning outcome. Both out- and in-classroom environments allow students to demonstrate the knowledge they learned (Reiser, 2001). For this purpose, a variety of tools and techniques can be used in instructional planning before, during, and after live instruction.
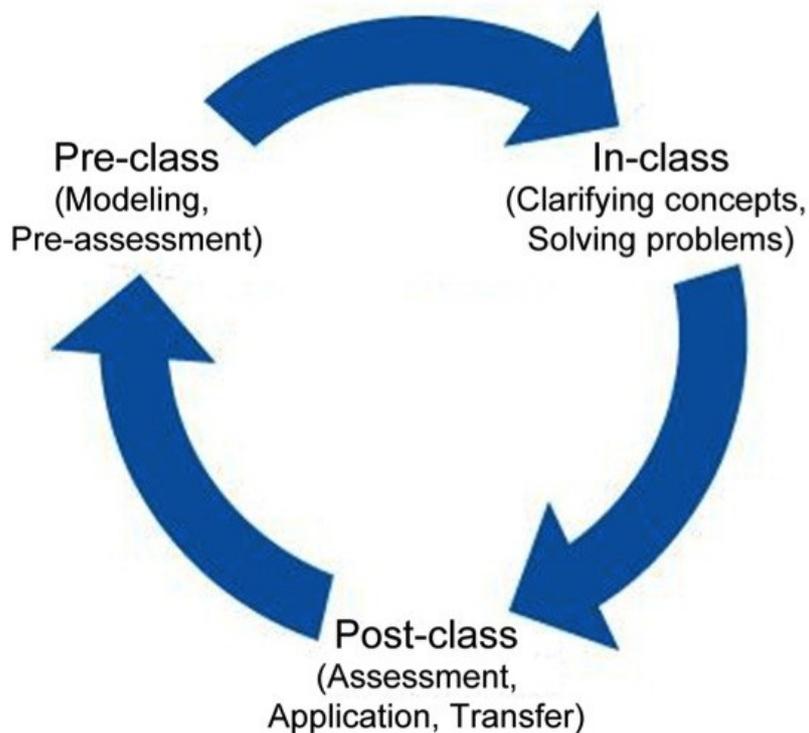
Figure 7: The stages of flipping a class (Estes, Ingram & Liu, 2014)

Most often, the flipped classroom model is characterised by its course structure: video-based learning outside the classroom and group-based learning activities inside the classroom (Bishop & Verleger, 2013; Lo & Hew, 2017a). According to a critical review of empirical studies on flipped classrooms, Lo and Hew (2017a) proposed a model of the flipped classroom approach in education, which consists of two parts: out-of-class learning (pre-Class and post-Class) and in-Class learning. In the out-of-class-learning part, students are asked to watch instructional videos, complete content notes, and take online quizzes. The central teaching method, in this part, is direct instruction and the focus lies on the cognitive levels of remembering and understanding (Wagner et al., 2021).

Not all teachers have an inclination to learner-centred environments, and the thought of moving to a flipped instructional design can be daunting. We propose a simple model for flipping the classroom, shown in Figure 7. The pre-class, in-class, and post-class sections of the figure reflect three general stages informed by the tenets of learning theory rather than specific technologies (Hsieh, 2017; Estes et al., 2014).

Before-class instructional phase (Pre-Class)

The first step for students to acquire knowledge in the flipped classroom is pre-class learning. Teachers arrange courses according to the teaching plan, and the students have to

learn before class according to the learning tasks assigned by the teachers. In the flipped classroom, the presentation of the new content takes place before the lesson, usually with short interactive videos that students have access to at home. The learning tasks are accomplished step-by-step, according to the learning plan, through collecting information online, downloading micro-videos forwarded by teachers, assigned readings, recorded lecture or short assessment (Hsieh, 2017).

Students can watch the digital material as many times as they prefer, and are able to focus on any issue they prefer in their own space and at their own pace. This enhances the students' familiarity with the educational material. In addition, collaboration between students outside and before the classroom can begin using communication tools. In other words, students are introduced to the subject matter before school leading to increased self-confidence and involvement. In addition, the teacher can classify the educational activities done at home in such a way that, in addition to identifying the students' needs, they can identify individual learning paths which meet the individual needs of all students.

Instead of using face-to-face classroom time, the teacher structures this type of activity in an asynchronous environment. A variety of technology tools may be helpful towards this direction. Rather than flipping an entire course at once, it may be more feasible to begin with only one aspect, shown in Figure 7, such as pre-assessment. This step requires the teacher to assess student knowledge before class time, in order to identify areas that necessitate clarification or emphasis during class time. Understanding students' needs prior to class time is the way that the teacher will know what kind of in-class adjustments to make (Estes et al., 2014; Hsieh, 2017).

Secondary schools can use a learning management system (LMS) for uploading online materials for instruction, and for engaging students online. In a LMS system, such as Moodle, the teacher can easily address low-level tasks by explaining basic terminology in detail or calculations. It helps teachers create, organise, and manage online experiences such as the asynchronous feature of flipped classroom instruction. The Khan Academy (https://www.khanacademy.org/) is a site that provides ready-made instructional resources that supplement or enhance the teacher's original work in the LMS system.

Teachers may design original, pre-recorded materials in a variety of media formats (Mazur, 2009). Recorded lectures and media are not uncommon in secondary education and their use is often associated with flipping techniques. The Khan Academy, mentioned earlier, is an example of a well-known online community where learners participate via asynchronous delivery by watching video and other media that animates, annotates, verbalises, and visualises the subject matter.

In the asynchronous environment teachers should assess student learning and mastery and use resulting data to effectively design the next in-class session. There is a wide range of free, electronic applications that offer survey and questionnaire features for this purpose.

Google Form, for example, offers multiple question types. The teacher may download results to Microsoft Excel for further analysis.

In case the material is online, students will need Internet access, the appropriate tools and access technologies available at home as well as platform use that supports home-based activities. In case of difficulties, the students could work together before class, or be given the opportunity to use the school lab. Students can use, in addition to their home computer, other devices such as a tablet or mobile phone. It is necessary to devote some time in advance to familiarise students with the use of digital tools. Students must have a basic familiarity with how to launch and navigate the learning material (Dahlstrom, Walker & Dziuban, 2013).

During-class instructional phase (In-Class)

The flipped classroom gives particular importance to the proper management of the teaching time, supporting the active participation of the student and taking advantage of critical thinking opportunities. Teaching time in the classroom can be better exploited, with activities aiming at consolidation, at knowledge application, according to the students' special needs. Students receive support from the teacher in their efforts to solve problems.

In the in-class-learning section, there is usually a brief review of the video and a question-and-answer session at the beginning of the lesson. Students can ask further questions about the video contents, which are answered by the teacher. If necessary, the teacher gives a short lecture on topics that students might not have understood while watching the videos. Then, individual practices and small-group activities take place which focus on the application of knowledge and problem-solving. The teacher may have already monitored the student activities on the platform, and having identified students' weaknesses can better organise the in-class lesson. The teacher has more time to apply contemporary pedagogical approaches. Students are supported by the teacher and their peers. At the end, the teacher concludes the lesson and gives instructions relative to the out-of-class learning activities for the next lesson (Lo & Hew, 2017a; Wagner et al., 2021).

The learning outcomes will vary according to the scenario. Far transfer occurs when learners are able to effectively apply skills and knowledge of what they have learned in a variety of new situations. They can transfer concepts that guide problem solutions rather than directly applicable automated routines. In far transfer learners adapt their actions based on their judgement of the situation (Clark & Mayer, 2011; Horton, 2012). Learning in this way requires an approach that is highly constructivist and typically team-based or social-based. In the classroom, the teacher divides students into groups and helps each student group individually, depending on their needs. This is the nature of the in-class instructional design for flipped classroom learning.

In the flipped classroom, the teacher will use questions and prompts to increase student-teacher contact through in-class discussion, observation, and potentially the use of technologies such as the learner response systems. For example, a teacher may review pre-assessment data to identify areas of weaknesses in student comprehension; then, generate a set of prompts and questions to explore those areas further during class (Estes et al., 2014). In the flipped classroom scaffolding, there exist, among others, activities which apply, develop or deepen knowledge acquired during reading or lecture, peer-work and small group work promotes structured interaction, allows for peer support, feedback and evaluation, peer and instructor support can be provided in in-class assessments (Hsieh, 2017).

Student to student interaction in the flipped classroom is also important, while it is common to use peer feedback and peer instruction for discovery and practice (Crouch, Watkins, Fagen & Mazur, 2007; Powell, 2003). The teacher may pose conceptual questions during the teaching procedure, to which students reflect, respond, discuss, and attempt to reach consensus on the answers in groups of three to four. This strategy, which promotes deep thinking, has led to significant gains.

Differentiated teaching and individualised support are facilitated, since the teacher knows from the first stage the individual needs of each student before entering the classroom and can give the appropriate support in the classroom - to properly support the student who is "having difficulty" and to push more the student who stands out (Bergmann & Sams, 2014). In using participatory teaching methods, the role of the teachers changes and they become partners and team/class facilitators. What is more, the role of the student alters. They develop initiatives, seek and use digital resources, investigate, actively get involved and play an essential role in the learning process.

After-class instructional phase (Post-Class)

Following synchronous and asynchronous activities of the flipped classroom, students can optionally return to the platform and check their level of knowledge. The teacher may have prepared self-assessment exercises for students to do at home, depending on their performance and after identifying potential weaknesses, students can go through the digital material again, watch the video anew, take another reflective look or expand their knowledge if they wish. In flipped classroom scaffolding, among others, all students have access to the peer/teacher feedback through in-class sessions, while assessments are completed independently to allow for more time; moreover, the development and follow up activities may further extend learning (Hsieh, 2017).

Before and after the asynchronous and synchronous components of the flipped classroom have occurred, teachers in the flipped classroom have the opportunity to increase and sustain student motivation for engagement outside class time, as well as to assess learner

progress. The teacher is advised to motivate students to engage in after-class activities by setting clear assessment criteria and organising a digital portfolio of their work (Estes et al., 2014; Hsieh, 2017).

For example, the teacher may incorporate external motivation that encourages in advance preparation, such as connecting out-of-class learning tasks with grades as well as setting clear expectations for in-class engagement. The teacher should use this time to design clear and consistent explanations of the flipped process, learning goals, and intended outcomes to accompany asynchronous pre-class materials. Finally, adoption of techniques that shift the role of teacher to the role of the learning coach will support the development of students' self-regulation skills, which are necessary for success in the flipped environment (Estes et al., 2014).

Ideally, in any course, students will begin to transfer knowledge and skills from one learning context to the other and apply what is learned to authentic situations. A variety of methods and tools are available to assess student learning after instruction. Rubrics are widely used to both articulate expectations and to measure student progress. However, developing effective rubrics takes time. Alternatively, students may present and demonstrate outcomes (Mabrey & Liu, 2013) in person or online using tools, such as YouTube.

2.4.5. Reviewing the effectiveness, the benefits and challenges of the flipped classroom model (for students and teachers)

The number of studies investigating flipped classroom in secondary school education has considerably grown in recent years (Clark, 2015; Huang & Hong, 2016). The flipped classroom model is applied to education, to many subjects and in various contexts. The flipped classroom can fully support the content of the curricula as an alternative educational model of mixed learning. Practical experience highlights benefits and challenges. Certain studies have shown positive effects on student achievement due to the flipped classroom approach (Lo & Hew, 2017b; Schultz, Duffield, Rasmussen & Wageman, 2014; Yang, 2017), while other studies have reported negative effects (Howell, 2013; Reyes-Lozano, Meda-Campana, & Morales Gamboa, 2014).

Flipped classroom is considered an instructional approach which combines the use of educational video materials for out-of-class learning and regular face-to-face-meetings regarding in-class-learning. It is a student-centred approach through which students have more opportunities for active learning.

Recently, G. Akçayır and M. Akçayır (2018) have presented a large-scale systematic review on advantages and challenges of flipped classroom. According to them, the most frequently reported benefit is that the flipped classroom improves student achievement. The latest and

probably the most comprehensive meta-analysis on the effectiveness of flipped classroom was conducted by Cheng, Ritzhaupt, and Antonenko (2018). They involved empirical studies across all student levels and subject areas with their findings revealing a statistically significant effect size in support of flipped classroom.

Another benefit is that watching instructional videos before class helps students better prepare for in-class activities (Kirvan, Rakes, & Zamora, 2015; Lo & Hew, 2017a). At home, students can review the video at their own pace, which helps them to better manage their cognitive content. Students also benefit as they improve their skills in using technology (McGrath, Groessler, Fink, Reidsema, & Kavanagh, 2017). In addition, in the flipped classroom, students already know the subject content, which can increase their self-confidence in class.

Another advantage is that the flipped classroom model allows for more flexibility and hands-on experience as well as more responsibility to the students (Casem, 2016; O'Flaherty & Philipps, 2015). This effect can promote self-regulated learning (Al-Harbi & Alshumaimeri, 2016; Hewitt, Journell, & Zilonka, 2014). It is also assumed that flipped classroom can fulfil students' need for competence, autonomy, and relatedness and can hence increase their intrinsic motivation to learn (Dixon, 2017; Kostaris, Sergis, Sampson, Giannakos, & Pelliccione, 2017; Lo, 2018).

Arguably the most important advantage of the flipped classroom is associated with letting class time devoted to a variety of active learning techniques and problem-solving activities (Lo & Hew, 2017a; Roehling, 2018). When students come to class prepared, teachers need to spend less time introducing new content. They can make more effective use of teaching time and support students in better understanding concepts. While in traditional classroom instruction many students are struggling with their homework assignments, students of the flipped classroom get assistance from teachers and peers whenever needed. This can be particularly useful for low achievers (Bhagat, Chang & Chang, 2016).

Students have more opportunities to apply their knowledge and engage in meaningful discussions on advanced problems (Esperanza, Fabian, & Toto, 2016; Lo & Hew, 2017a; Sezer, 2017). In view of the fact that students have already attended the lecture during the Before-class instructional phase, they can have an efficient answer to relevant questions arising during class sessions, in addition to asking questions, thus receiving personalised support. Students are motivated to engage more actively in classroom collaboration. They learn by working with peers to solve problems or by supporting their own solution in schoolwork. Collaborative activities, which are carried out in the classroom, promote the team spirit and the socialisation of students - learners. As a result, students do not only develop subject-related competencies, but also important soft skills, such as teamwork and communication skills (Lo & Hew, 2017a; Smith, 2015), ICT literacy and critical thinking skills (Kong, 2014). To sum up, there is a number of strong arguments in favour of the flipped

classroom approach. Students are assumed to become more independent learners, achieve higher learning outcomes, and develop 21st century skills (Chao, Chen, & Chuang, 2015; Graziano & Hall, 2017; O'Flaherty & Philipps, 2015; Olakanmi, 2017).

Quite recently Wagner, Gegenfurtner and Urhahne (2021) performed a meta-analysis examining the effectiveness of the flipped classroom on student achievement in secondary education. This meta-analytic study aimed to answer whether the flipped classroom approach has a positive impact on student achievement in secondary education by summarising six years of research, cumulating 44 independent data sources with 86 effect sizes from 2,323 students, and examining four potential moderator variables. The findings provide significant evidence of flipped classroom effectiveness in secondary education on student achievement in comparison to traditional instruction. It is worth mentioning that moderator analyses on the effect sizes "time" show stronger impact in STEM subjects (science, technology, engineering, mathematics) than in foreign languages and humanities.

Hultén and Larsson (2018) conducted research in Sweden, aiming to contribute to an increased understanding of the flipped classroom approach. A total of 7 teachers working in school years 4–9 and who both actively flipped their classrooms were interviewed. Two research questions were posed: "What characterises a flipped classroom instruction according to the teachers?" and "What objectives does the flipped classroom meet according to the teachers?" Regarding the first research question, a characteristic of a flipped classroom was "the flip," a task to be accomplished outside class before class. In relation to the second research question, they found three objectives: student activity in class; educational change; being part of a digital learning community.

In any case, the flipped classroom approach is associated with a number of disadvantages and challenges. In a recent review, G. Akçayır and M. Akçayır (2018) provided a comprehensive summary of typically encountered challenges when flipping the classroom. The first and by far the most problematic issue is related to out-of-class activities, such as limited student preparation prior to class and students' need for guidance at home, which result in reduced motivation. While many teachers agree that flipped classrooms allow for a self-paced learning experience, teachers who use a flipped classroom have to assume that students who are less motivated will struggle in that setting. These issues may occur due to lack of self-regulated learning skills (Lai & Hwang, 2016; Yilmaz, Olpak, & Yilmaz, 2018). To cite an instance, if students do not watch the video beforehand, they cannot participate well in classroom activities and all the advantages of flipped classroom may vanish. In general, a flipped classroom imposes higher workload on both students and teachers, thus it is more time-consuming (Akçayır & Akçayır, 2018; Lo & Hew, 2017a). To further clarify the issue, students are not used to acquiring knowledge by themselves and they might not enjoy such an approach.

Another challenge is related to technical and technological issues, e. g., the quality of videos, students' access to technology, especially for students from low socioeconomic backgrounds (Perrin, 2015). Educational, student-related, teacher-related, technical and technological issues, access to Web-based resources are also some of the challenges (Akçayır & Akçayır, 2018).

The flipped approach is a mindset of constant reflection, engagement, and investigation. Such a mindset is relevant to the classroom and to professional and academic inspirations we hope to be promoted in class. When flipping a single lecture or an entire course, with clear objectives, well-chosen and chunked materials, active, engaging class sessions, then teachers and students can experience the powerful learning opportunities of the flipped model (Hsieh, 2017).

The involvement of teachers in the flipped classroom model contributes to their professional development through the reinforcement of digital skills. Teachers have to create videos and prepare out-of-class as well as in-class activities. The idea behind student-centred learning is not just to meet the students' understanding, but also to provide them with opportunities for self-confidence building based on their responsibility and autonomous skills regarding the desired type of learning. Teachers have to cope with multiple learning styles through the advantages of the flipped classroom. The differentiation of teaching is supported according to the readiness, the interests, the students' learning profile and the access to a variety of resources offered by the educational facilitator is facilitated (Hirsch, 2014).

Concluding, the flipped classroom is one of the most common models of blended learning. A well-organised flipped classroom can have several benefits. Summarising and extending what was preceded, the flipped classroom allows for student-centred active learning. It incorporates the idea that students are no longer passive recipients of information while the teacher is not considered as the only facilitator. Traditional classroom learning tends to rely on the delivery of a lecture, where students listen passively to the required material. In a flipped classroom, students can be more active and collaborative in their learning through application and evaluation activities during class time, activities that foster critical thinking and creativity (Mazur, 2009; Westermann, 2014).

So far, we have presented practical strategies for the effective implementation of the flipped classroom approach. Video instruction in and of itself does not appear accountable for changes in learning performance, but may provide additional time for in-class activities that enhance learning performance due to active learning (DeLozier & Rhodes, 2017).The literature review supports that the flipping technique is useful when seeking to optimise class time, supports the development of higher-order thinking skills, and enhances teacher-student and student peer-to-peer interactions (Wallace, Walker, Braseby & Sweet, 2014). The success of a flipped approach depends on the synergy between teacher and students whilst flipped classroom requires sustained motivation and contribution before, during, and after

live instruction. When used appropriately, flipping the classroom can be value-added in secondary education practice as it evidenced in the research.

Because the principle of the flipped classroom model is class activities, like problem-solving, to be completed in class, and with the teacher and peers to assist where needed, students feel free to become more engaged and actively seek learning through online and digital tools (Clark & Mayer, 2011; Horton, 2012). In classroom periods, they can also improve learners' social skills and the sense of community as well as offer personalised support for learning by teachers. With reference to teachers, the flipped classroom allows for assessing all learners through differentiation and personalised teaching.

There is one final critical component to flipping your class. Flipped classroom practitioners and advocates (Flipped Learning Network, 2014) note that flipping the classroom involves more than changing the type of a course; more critically, flipping involves changing one's own instructional mindset and supporting students in changing their mindsets and approaches in relation to the flipped course. The flipped mindset for students is based upon self-regulated learning, collaboration skills, and active engagement with the learning process. Students who stand out in the flipped classroom must be responsible for their pre-class learning and willing to work with their peers and teacher collaboratively through active engagement in in-class activities. For the teacher, the flipped mindset requires active engagement through reflection. Prior to flipping, we must honestly assess our strengths and weaknesses in relation to technology, instructional planning, inquiry-based and collaborative learning, finding resources or support to overcome areas of weakness while drawing from areas of strength. During the course, we must constantly reflect on student learning and participation, while giving regular feedback to students. Reflection in practice and adaptability will promote greater sustained momentum in the flipped classroom. Finally, after any flipped course, reflection on how to improve the material and methodologies for the following course is imperative to ongoing professional growth (Hsieh, 2017).

With a blend of in-school and distance learning, teachers support students' individualised learning, increase learners' autonomy, and improve learning skills towards becoming self-directed learners. Teachers use technology tools to enhance the digital skills of students. The various approaches successfully implemented prior to the flipped classroom model, the use of video, and digital instructional resources create ample opportunities for its application in all subjects, including Mathematics, Physics and Foreign Languages, the core subjects of the CONNECT project.

Nevertheless, "*Education is a fundamental human right and a right of the child. Access to it has to be guaranteed, independent of the environment in which it takes place – the school site, at a distance, or a combination of both – and independent of the different personal and social circumstances of learners. Beyond the pandemic, a blended learning approach is an*

opportunity to improve the quality, relevance and inclusiveness of education and training"
*(*European Commission, 2021, p. 11).

2.5. Differentiated teaching and learning in digital environments

Teachers in digital classrooms should adapt the educational content, process and products to the diversity of their students, with the aim to create a flexible digital environment that highlights and serves different interests, skills and learning profiles. Using image, sound, digital motion, interactive communication, students' participation in the processing of information and new knowledge is required.

Methods and tools of Differentiated Teaching can form the pedagogical framework under which an integrated, authentic learning process can be accomplished as a coherent in a face-to-face or even digital classroom can be built as a single coherent whole.

Why we need differentiated teaching

It is common ground that never and nowhere is a group of trainees and especially a general school class completely homogeneous. Students of each class of any level of formal education appear with different interests, preferences, learning style, readiness, skills and abilities (Ziskos & Papadakis, 2015).

Not even this presumptively common purpose of its members, the acquisition of knowledge, is a given. In fact, when a teacher tries to teach something by addressing the whole class, chances are that

- one - third of children already know this,

- one - third will understand it,

- and the remaining one-third will not understand it at all (Katz, 1996, p. 141).

Therefore, two-thirds of students waste their time.

But why are all these students wasting their time? The main common element and the clearest reason is the fact that uniform and horizontal perception often pervades traditional teaching practices. it is confronted with the heterogeneity of the group of children to which it is addressed each time. Sources of this heterogeneity are generally the following:

- **Multiculturalism:** We refer to the cultural capital of students and families which affects, often decisively, the degree of possession of the dominant-model language of the school as well as the degree of familiarity with the dominant culture, history, manners, customs, habits, of the community they attempt to be integrated in through school.
- **Socio-economic level.** The socio-economic status and each family lifestyle differentiates students in the way they shape and they shape and constantly readjust what they want from school and how they want to achieve it. That is, the dynamics of change determine and constantly re-define the students' expectations.
- **Students' expectations.** The evolution of expectations constantly shapes students' attitudes towards school. It goes without saying that this is strongly influenced by the students' differentiated interests and motivations as well as the interpretations of what is realised in school.
- **Students' Cognitive structures and functions.** The difference in the reception and processing of information, in the mnemonic abilities, in the analytical or synthetic thinking, in the ways of communication.

The heterogeneity factors promote differentiated teaching which is gradually required in most educational systems around the world (Gabor & Key 2011, p. 297).

What is and what is not Differentiated Teaching

In order to be able to have a clear framework within which scenarios for the application of the principles of differentiated teaching will be proposed, it is useful to clarify the meaning of the term, in order to extricate the term from a conceptual content that refers to uncontrolled learning practices.

What is not differentiation

In order to remove any misunderstandings, meaning starts from what is not differentiation in the educational process:

- It is not personalised teaching. It is not intended to formulate a specific methodological approach for each and every student.
- It does not imply relaxation in the team and in the classroom as a whole. On the contrary, space organisation and working with clear instructions in group work are required.
- It does not imply heterogeneous groups but homogeneous groups of similar performance and abilities in class, even though students prefer to work in groups with common interests and needs but diverse abilities and school performance.

What is differentiation: Definition and pedagogical principles of differentiated teaching

So what is differentiation in teaching? According to Jensen "Differentiated teaching is an interactive process between the student and the teacher, through which the teacher responds in advance to the particular and unique needs of the student, while the student can actively participate and learn continuously to the extent of his abilities." (Jensen, 1998, p.28).

Thus, an educational practice must comply with some principles summarised below.

- **Acceptance of diversity.** All students want to contribute and be accepted by their environment. The diverse classroom offers opportunities to realise the value of diversity, justice and collaboration.
- **Possibility of choice.** Students in a diverse class have the choice of what they learn, how to learn and how to express what they have learned. The learning environment needs to provide a variety of choices regarding what and how to learn in order to satisfy individual abilities and different talents.
- **Collaborative work.** Most teachers agree that students learn best through collaborative processes with their classmates and with their teacher. Collaboration makes learning activities more attractive and enjoyable, develops students' self-esteem, especially those with learning difficulties, and helps them acquire life skills necessary for the future.
- **Connections.** New knowledge is stored in long-term memory when it is linked to the student's previous experiences, knowledge and interests. In the case of Foreign Languages, for example, the new knowledge must be linked to the mother tongue, to their pre-existing knowledge and the reality they live in. Any such connection is positive and is an important goal in any differentiated teaching course (Neophytou & Valianti, 2015, p.54) .
- **Multiple methodological approaches** to learning. Neuroscientific research of the brain proves that man learns through different methods: investigation, memorization, technology, socialisation and much more (Ali 2014, p.41). In the differentiated classroom, multiple methods of learning and teaching are applied in combination. Learning is no longer a one-way approach but an act of interaction and exploitation of various tools. Differentiation does not ask the teacher to change the way s/he teaches but to expand her/his repertoire in order to reach out to more students.
- **In the case of mathematics and natural sciences, the educational process must highlight the children's previous knowledge and experience** of the subject being examined and, if necessary, revise and supplement, or even completely disprove it.

- **In the case of Foreign Languages, new knowledge must be linked to the mother language,** to their pre-existing knowledge and to the real world in which they live. Any connection has a positive effect and is an important goal in any differentiated teaching course.
- **Open learning environments.** Learning about a topic can take the form of investigation, through providing new dimensions. Students are urged to ask more questions (curiosity is important for learning) than to provide answers. Methodological strategies and tactics, such as Socratic midwifery, and activities aiming at the higher learning levels of the Bloom taxonomy briefly described are strategies that provide open teaching standards necessary in a differentiated classroom.

Scenarios of educational practices based on the principles of differentiated teaching.

We are therefore looking for a mix of educational practice tools that can meet the above requirements. As such, it is preferred in the proposed scenarios of the CONNECT project to exploit the principles of differentiation in combination with the methodology of the Flipped Classroom. As Joe Hirsch, initiator of the mixed learning teaching model he calls "Fliperentiation", argues, combining its two components (Inverted Classroom and Differentiated Teaching), this combination enables teachers to quickly and effectively engage learners in the appropriate learning activities for them, enriching their learning experiences and facilitating the learning process (Hirsch, 2014 refers to Papadakis - Baxevanis 2020, 206).

According to the "Fliperentiation" learning model, the course is organised and conducted in three (3) Phases (p.p. 206-7). During Phase A, students are provided with diverse educational content (websites, texts, audio files, video files, photographs, etc.) for autonomous study which must be relevant to the planned individual or group experiential activities of Phase B which are carried out by the students in the classroom. Each learning planning is completed with Phase C' where the participants are provided with alternative activities evaluation, which can be carried out at home or at school and evaluated formally or informally. Differentiation can be applied with the help of technology in any Phase of the model, enhancing the ability of choice that is a key feature of Differentiated Teaching.

The scenarios that are formed within the framework of our program, are appropriately adapted to the above structural scheme, and are essentially built in two ways:

A. based on the choice of the objectives of educational practice: it is considered that differentiated teaching should initiate from a clear framework of objectives.
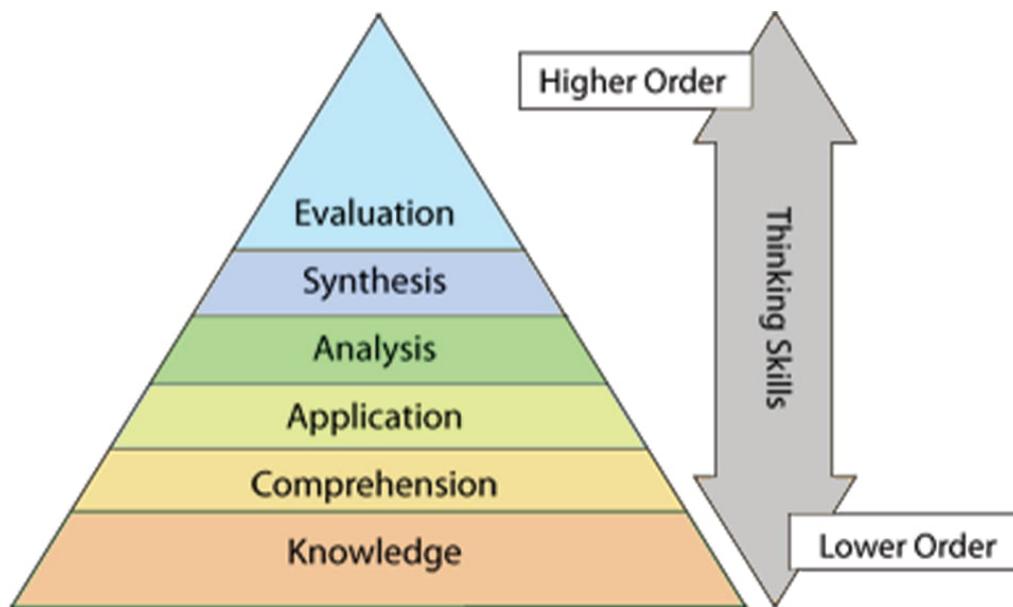
Figure 8: The target classification pyramid by Bloom

Bloom (1956, vol.1) has proposed the above escalation of objectives for the process by which the assimilation of the object that is the purpose of an educational practice is attempted. We observe that in the evolution of this scale from the bottom to the top, the range decreases, which means that as the difficulty of the target increases, correspondingly the margins of tolerance in the estimation of its degree of fulfilment decrease.

B. Based on the content: The concept includes the basic information (vocabulary, phrases, syntax types, concepts, etc.) that the students must understand and the skills that the students should be able to demonstrate. The content is the "entrance" of the course. What is important in a diverse classroom is the ability of students to access various forms of content and at the same time the freedom to choose what they would be interested in studying. The teacher should be careful to differentiate the content but not have different content.

All the above are taken into account in the proposals formulated within the framework of the CONNECT programme. In the proposed scenarios of our program, it is intended for children to be grouped into small groups of 3-4 people, depending on their common needs, and they work as a teamwork, and the teacher guides each group separately, depending on the particular requirements arising from the combination of the content of the lesson and its particularities. A wide variety of digital tools are also used, such as simulations, videos, interactive applications, not only as alternative routes of educational intervention but also autonomously. Thus, with the activities proposed and especially with their alternative

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variants that with appropriate interventions of the teacher can be adapted to the particularities of the specific group and educational context, the teacher has the opportunity:

- start with the development of pupils' oral language skills,
- use a variety of visual and other materials taking into account the cultural and social context of the students,
- use stories in patterns to build new learning on the basis of what students already know, and
- provide students with authentic experiences such as presentations with speakers in the target language.

To sum up, differentiated pedagogy is not a specific method with a clear structure and predetermined rules, but an open pedagogical concept which meets with that of the interdisciplinary approach to knowledge and active learning. It gives an answer to why and how enhancing each student's individual path to building knowledge is essential for school success. It is a tool that strengthens the knowledge and skills of each student and enables everyone to realise the specificity of their own approach and learning strategies. It is certain that its most effective application leads each child to achieve the fullest development of the skills necessary in the modern world.

2.6. Development of the 21st century skills in a digital educational environment

Skills of the 21st century

The Council of Europe (http://www.coe.int) in the context of cultivating a democratic awareness and culture has highlighted as objectives for the education systems of all Member States of the four main learning skills of the 21st century:

- **Critical thinking:** can be defined as the ability of children to raise questions, process, interpret, analyze information, sources, opinions, evaluate and draw conclusions that will lead to deliberate selection and decision-making.
- **Communication:** concerns the ability of children to converse with peers and teachers, to express their ideas, thoughts, feelings, verbally, in writing and non-verbally, in different circumstances, in order to inform, convince, motivate, guide, share personal experiences, etc. decode and interpret knowledge, values, attitudes, behaviours and intentions they perceive.

- **Cooperation:** the ability of children to participate in activities, tasks and projects to achieve a common goal set by the group, within a framework of mutual respect for different ideas, opinions and experiences, consensus and compromise.
- **Creativity:** Defined as the ability of children to produce new, original and useful ideas that have meaning and value, creativity is linked to their effort to raise questions about a problem they identify and to seek innovative and beneficial solutions for it.

All the above were systematically attempted to be incorporated into the proposed scenarios of the CONNECT program. More specifically, with the methodological approaches used, **communication and cooperation skills** are cultivated. We all want in this program, in the implementation of the proposed actions, the **students:**

- To seek cooperation, which as a way of life arises from the understanding of the need to share the work, during the group research process, with spirit, dialogue and mutual respect.

- To converse within the group, developing analytical and synthetic competence through fruitful dialogue to achieve specific goals

- To propose to the group, to organize and implement their proposals, i.e. to observe recording, and where necessary to measure, calculate, link data and collectively draw conclusions

Similar is the effort for critical **thinking and creativity skills:**

- To observe, distinguish, compare and describe phenomena, processes and practices of their investigation.
- To correct possible errors in the process of these practices.
- To formulate arguments and reach conclusions, i.e. to analyse the results of their investigation, and to correlate them with the initial hypothesis.
- Trust and critical attitude towards the generalisations that arise as conclusions and are characterised as scientific.
- Reflective attitude to the limits of the implementation of an educational practice, i.e. where, when and with what limitations a process is necessary, possible and legitimate to solve a problem or explain an event.

The above objectives need to be adapted to a digital learning environment (European Association for Adult Learning, 2018, p.1), so that it is functionally possible for all these skills to be fully expressed in digital environments.

The proposed scenarios seek to enhance digital creativity, communication and collaboration, by combining their methods and content in a structure that is as effective as possible, utilising all the available tools of a modern digital environment in a harmonious whole.

What are these tools available? Simulations, interactive applications of direct and indirect communication, asynchronous training platforms in all special subjects, creation and educational exploitation of videos, photographic collections and digital constructions. It is also done with appropriate adjustments depending on the subject, wide use of the ways of communication of young people through digital social networks.

All the above acquire a special, even more important meaning when the teacher is called upon to promote them by incorporating the principles of inclusive education, of differentiated teaching. In this venture that seems particularly demanding, the cultivation of the ability to manipulate language is crucial and is a key priority in all subjects.

Taking into account the framework of principles of inclusive education and the targeting for the development of the skills of the 21st century with emphasis on their digital aspect, in the proposed scenarios of the CONNECT program we consider that it is necessary and seeks to highlight:

- Presentation formats that highlight attractive areas of engagement for all children without discrimination.
- Methods that inspire all children to trust in the educational process and therefore push them to participate.
- Practices that enhance the linguistic culture for all children and especially for those who are refugees and migrants, as in all scenarios there is a combination with practice in linguistic literacy.
- Patterns of thought and action that enable children to think critically and act collectively.
- Group-working environment, in the context of which the integration of all is sought, as emphasis is placed so that all children, especially in refugee and migrant children, can express in all phases of each particular educational practice, the desire to participate in this action in harmonious cooperation with the rest

To the extent that all these are fulfilled to the greatest extent possible with the proposed scenarios, it is estimated that it is possible to enrich the available tools for the educational process in the subjects of the program. With one necessary condition: that there must always be in the mind of the teacher the central purpose, condensed into a single word: integration.

2.7. Online Assessment to Support Meaningful Online Teaching and Learning

This section is concerned with the basic principles of assessment and particularly online assessment, looking at issues such as its aims and purpose, its basic characteristics, its types as well as some of its representative methods that could be used for assessing students online. The relation to online teaching and learning will also be addressed, a process that encourages the understanding of teaching taking into consideration some of the benefits of getting feedback from learners about the learning outcomes, thus, creating good classroom rapport.

Living in the digital era actually implies that every human activity is overwhelmed by technology, a fact applying to teaching and learning as well. The learning process, which is a complex one, has acquired new characteristics and a distinguishing new quality. Innovative technologies support the traditional way of learning, empowering at the same time students' learning process. Hence, technology is rapidly transforming the way students and teachers interact while adapting to the online model of learning and teaching. The new situation in education, therefore, is the increased use of online learning tools since the Covid-19 pandemic has triggered new ways of learning and education has now definitely come out of the traditional classroom teaching to more flexible formats. Teaching and learning is not confined to classroom settings as it has been historically.

During the previous period we have seen a noticeable shift of emphasis and a positive encouragement towards more and more digital learning. Cruz et al. (2017) claim that "digital learning methodologies are new methods of teaching using technology with the purpose to improve the quality of education and involve students in the educational process". As a result, online education has become an important teaching alternative, and new challenges about how to teach have to be addressed. So, the focus of education worldwide has been supporting learning, having swayed towards continuous learning anytime, anywhere.

According to UNESCO (2020), social distancing had to be implemented suspending classroom teaching, leaving many both primary and secondary students without face-to-face teaching activities during this period. Consequently, educators and policy makers faced the challenge of finding new ways to teach in order to maintain students' contact with the learning process. Thus, in an effort to address the topic the decision-making process led to using online education. In fact, this option meant offering online courses using homochronous and heterochronous activities at the same time. The combination of the aforementioned structure seemed that it would yield positive effects то make up for the lack of traditional face-to-face classroom teaching.

In the present era, online learning has been more common than ever before being a commonplace education strategy. Being a byproduct of the Covid-19 era, there was no other

choice to the suspended classroom teaching, since online learning provides more flexibility and convenience than traditional education (Eckstein, 2007) definitely requiring, however, some major adjustments. Education staff and Ministry officials still have to reflect on the outcomes of the learning process through assessing and monitoring the teaching practices used. Due to the existing considerations, key actions have to be undertaken in order to ensure the continuity of quality learning as well as of quality assessment. It should be taken for granted, however, that the main reason to administer online assessment during the pandemic was "to better understand and address the extent of the gaps in education among students and student populations that have been made worse by the coronavirus pandemic" (Jimenez, 2020). The latter implies that assessment is a process that can take place in any existing learning condition, the main difference lying only in the method of delivery since "all types of assessment happen in various learning environments, be it face-to-face, a blended, or an online learning environment" (Bakerson et al., 2015).

a. Assessment: Aims and Implementation

Bakerson et al. (ibid) point out that "assessment is the systematic process of documenting learning through measurable evidence. It is used to measure knowledge, skills, dispositions, or beliefs gleaned through instructional sequences, with an aim to improve all aspects of student learning." whilst Harlen (2006) argues that "assessment in the context of education involves deciding, collecting and making judgments about evidence relating the goals of the learning being assessed". Nonetheless, Capraro et al. (2012) claim that "at the classroom level, teachers must decide which specific knowledge, skills, attitudes, and beliefs warrant assessment; at what point and for what specific purpose they should be assessed; and which tools might best accomplish these classroom-based assessments." That is the reason why Brewer et al. (2015) pinpoint that "the process of designing and implementing achievement tests is complex and requires a level of expertise". Hence, the complex process of assessment seems to be inextricably linked to the teaching and learning process. Actually, student assessment, a ubiquitous term for everyone involved in education, is deemed an imperative part of the education process being at the same time a great challenge for all teachers.

It becomes obvious, then, that there are two parameters with reference to assessment, the learner and the teacher. It facilitates students to realise what they have learned and where they stand in the progress of learning achievements, while, on the other hand, teachers obtain information about their students' strengths, weaknesses and needs, always aiming to further improve their teaching practices. For assessment purposes, tests are created by educators and teachers to meet the aforementioned distinct purposes that include an array of constructed response items followed by an answer to be selected. Commonly, they are used to measure students' understanding of the specific content during a course in addition to checking the effective application of critical thinking skills. This way, they provide data and information not only on student learning but skill level growth as well. Therefore, academic

achievements can be measured and evaluated on the whole at the end of an instructional period, or at the end of a project, unit, course, semester, program or school year.

Consequently, effective teaching and learning can be supported since informed decisions can be made with reference to course content and curriculum in order to improve learning outcomes. "Proponents of data-informed decision making call on educators to adopt a continuous improvement perspective with an emphasis on goal setting, measurement and feedback loops so teachers and administrators can reflect on their programs and processes, relate them to student outcomes, and make refinements suggested by the outcome data" (U.S. Department of Education, 2009). Data collected from student assessment, then, which may come from different forms yielding in fact different types of information, can be used for various purposes. It can be concluded that since the ultimate goal is to influence teaching, learning, and learner achievements, assessments and adequate yearly progress continue to represent the driving forces of school improvement.

Yet, although the main concern continues to be educational achievements of students at all levels, according to Bakerson et al. (2015) "what worked to promote accountability in face-to-face settings in the past does not necessarily work in online environments (Goldstein & Behuniak, 2012). The pedagogical theory is the same; however, the implementation varies across learning environments". The online learning delivery method may offer a number of opportunities unique to students since they are familiar with technology tools nowadays, which actually can be used to implement and foster enhanced student engagement with the learning experience. As a result, the triangle of teaching, learning and assessment will acquire value-added features being eventually meaningful for learners.

b. Online Assessment: A Step beyond

Online learning can be defined as "instruction delivered on a digital device that is intended to support learning" (Ferri et al., 2020). Combining traditional face-to-face learning environments with online education tools and approaches seems to raise challenges for teachers and educators for the creation of an active, authentic, and collaborative environment for students in order to achieve meaningful learning experiences, which is, after all, a major objective of education. It has been widely accepted that teaching and learning are epitomised in student assessment whereas this continues to be applied in online assessment as well.

In an effort to adapt to the current situation, the sector of Education has been able to streamline their examination processes with online assessments, be it student continuous assessment, semester exams, end-of-the unit exams, etc. Online student assessment is conducted on web-enabled devices accurately assessing a student's knowledge in a wide range of subjects, always taking into consideration the curriculum goals. The introduction of e-assessment practices is now considered as an integral part of both traditional and online education. Moreover, the innovative use of technology-enhanced assessment has been "a

stimulus for change, and is of current strategic importance internationally" (Whitelock & Watt, 2008).

Undoubtedly, assessment is perceived as an appraisal of learning outcomes and students' performance "having fundamental effects on learners" (Black & William, 2006). Hettiarachchi et al. (2015) assert that "especially when it comes to online education, the advances in technology offer interesting possibilities, if used appropriately, to build practice tools and can add value to any of the activities associated with assessment … where students' active participation and engagement through practice is needed along with a continuous assessment carried-out during the learning process". Therefore, it follows that e-assessment offers opportunities to teachers for creating innovative assessment practices that help engage students and increase their motivation for learning. The e-learning movement contributes to creating tools able to improve student engagement and performance, offer possibilities to practise competencies and skills, provide personalised feedback, ultimately, improving student motivation. Hence, the impact of online assessment on students' learning may be characterised as beneficial playing a significant role in the teaching/learning process. As Perera-Diltz & Moe (2014) put it "learners prefer both the flexibility and convenience of online education (Hewson, 2012), while also indicating expectations for personal achievement comparable to face-to-face learning environments (Stewart, Waight, Norwood, & Ezell, 2004)".

However, in practice applying e-assessment requires a pedagogically appropriate model that will allow all students to take more control of their own learning exploiting in full the feedback given by teachers as long as "timely and constructive feedback motivates students to learn more effectively" Bull in Hettiarachchi et al. (2015). This way learners will become more reflective on the process they participate in since "research shows that effective learning requires that students actively decode feedback information, internalise it and use it to make judgments of their own work" (Whitelock & Watt, 2008). As regards the benefit of making learners reflective, Sougari (2006) claims that "reflection can be defined as the process of looking at their experiences by examining actions, reactions and thoughts to reach a better understanding of the teaching situation". Unless students internalise the process and steps of teaching, will they be willing to fully take part in the teaching, learning and assessment process being at the same time motivated.

Although online assessments are developed from conventional forms of assessment by converting its paper-based versions into e-formats, it has been lately realised that this transformation may offer a number of additional advantages. In fact, it can complement traditional forms of classroom assessment making it valid providing reliable data for student performance, Knowledge and skills as well as engaging, hence, responding to learner needs. Accordingly, it will constitute a meaningful process, which could be frequently applied. So, learners perceive assessment as more relevant to their learning style being at the same time adapted to up-to-date student-teacher interaction. The main advantage of this

examination system is that it can be used to administer paper- less tests and also get instant test results. Lastly, it is worth clarifying that e-assessment, like conventional forms of assessment, should be constantly aligned to the curriculum stated learning outcomes no matter what types are administered for implementing assessment.

c. Types of Assessment: Definitions, Purposes and Benefits

With reference to the types of learner assessment, the existing literature traditionally encompasses two categories as follows: summative and formative assessment, making, however, distinctions regarding the scope, the aim, the tools used for each type of assessment and the use of assessment results for different purposes. Harlen (2005) points out that "the two main purposes of assessment are for helping learning and for summarising learning" adding that "it is sometimes difficult to avoid referring to these as if they were different forms or types of assessment". She also argues that in fact they are not and they are discussed separately only because they have different purposes.

i. Summative Assessment

Summative assessment attempts to capture the culmination of students' achievements within a specified time frame; summative assessment is assessment of learning (Stiggins & Chappuis, 2006). Taras (2005) supports that summative assessment constitutes "a judgement which encapsulates all the evidence up to a given point" clarifying that "a judgement cannot be made within a vacuum, therefore points of comparison, i.e. standards and goals, are necessary". It is a process having various functions, which do not impinge on the process of assessing learners itself. As an evaluation of content mastery that focuses on learner outcomes, summative assessment "compares student knowledge or skills against standards or benchmarks … and consists of evaluation tools designed to measure student performance against predetermined criteria based on specific learning standards" (States et al., 2018). Summative assessment is administered repeatedly throughout the school year and it is used as "an indicator of what students have learned at the end of a given period, at the end of a learning unit, term, school year or educational level" (Eurydice, 2009b). Summative assessments often have a high point value that is why they mostly take place under controlled conditions.

Taking place after teaching instruction is over, it does not allow teachers to organise remedial actions or adjust teaching practices in time. As Fasih et al. (2019) put it, "summative assessment focuses on past performance but does not offer possible direction to improve learners' performance in the future". Therefore, summative assessment captures a moment only during the teaching and learning process that gives information about students' achievements within the parameters of the specific test, testing environment as well as the overall conditions of test taking. There is no opportunity, then, to change future instruction practices and take action on students at risk of failure as "summative assessment

is a measure of an end product (Perera-Diltz, 2009), and at best represents a holistic and qualitative appraisal of whether specified learning outcomes were achieved" (Perera-Diltz, 2014).

Summative assessment, nonetheless, still plays a pivotal role in education as it may affect the progress of students, in spite of the aforementioned shortcomings. Additionally, it has a crucial importance in relation to the success of teachers' efforts to improve educational outcomes for all students. Since stakeholders of education may use the results of summative assessment for students' future, it follows that they should have confidence in these results, consequently, raising the issue of quality. Black & William (2006) argue that "there are two main criteria of quality of an examination results that should be a basis for such confidence: reliability and validity". Yet, it should be clarified that no matter what type of assessment is used, the underlying framework still remains the same as long as its implementation satisfies certain criteria for their validity and reliability. The latter, after all, are considered as key concepts regarding any assessment process. According to the Organisation for Economic Co-operation and Development (OECD, 2013),

Validity relates to the appropriateness of the inferences, uses and consequences attached to assessment. A highly valid assessment ensures that all relevant aspects of student performance are covered by the assessment.

Reliability refers to the extent to which the assessment is consistent in measuring what it sets out to measure. A highly reliable assessment ensures that the assessment is accurate and not influenced by the particular assessor or assessment occasion.

States et al. (ibid:4) support that validity is "a measure of how well an instrument gauges the relevant skills of a student" whereas they consider reliability as "key in the development of any teacher-constructed assessment because teachers must be assured that repeated testing of a student using the same assessment will produce consistent results". Therefore, the main issue regarding test validity is whether the results of testing may be used to improve learning outcomes for all students since they may affect student progress while a reliable assessment should provide teachers with a clear depiction of students' skills and knowledge.

With reference to the forms of summative assessment, two different forms are identified in the existing literature making a distinction between internal and external assessment regarding the person implementing it, as follows:

Internal assessment, or school-based assessment, is designed and marked by the students' own teachers, and implemented as part of regular classroom instruction, within lessons or at the end of a teaching unit, year level or educational cycle. Other examples of school-based assessment include reports, projects, and mid-term examinations. This teacher constructed assessment is the most common and frequently informally applied assessment being, nonetheless, vulnerable to bias. Harlen (2005) provides a number of

reasons for implementing regular internal assessment and grading for recordkeeping, informing decisions about courses to follow in case there are options within the school, and reporting to parents and to the students themselves.

External assessment, or standardised assessment, is designed and marked outside individual schools so as to ensure that the questions, conditions for administering, scoring procedures, and interpretations are consistent and comparable among students (Popham, 1991 in OECD, 2013). Standardised tests administered systematically and formally are used for high-stakes purposes such as university and college admission. They are used extensively in educational settings to determine if students have met specific learning goals. Nevertheless, the use of high-stakes exams is "universally found to be associated with teachers focusing on the content of the tests, administering repeated practice tests, training students in the answers to specific questions or types of question, and adopting transmission styles of teaching" (Harlen, 2005). If done carefully while assuring a high degree of quality, they can eliminate bias and prevent unfair student treatment by testing the same or similar information under the same testing conditions.

According to the OECD (2013), however, it is important to always have in mind that "both internal and external assessments may be used in a summative or formative way", as will be analysed in the next section. Furthermore, in practice, there are cases that the distinction between internal and external assessments is not always so clear-cut as long as there are also hybrid forms of assessment that are developed externally but implemented and marked internally by the students' own teachers as the need arises.

In addition, a broad categorisation of summative assessment under the criterion of time implementing it may be the following:

Diagnostic tests, administered at the beginning of the school year prior to instruction, is a form of pre-assessment used by teachers for students' evaluation of current knowledge and skills identifying at the same time strengths and weaknesses. However, according to the Organisation for Economic Co-operation and Development (OECD, 2013), diagnostic tests may as well be considered as one aspect of formative assessment identifying "students who are at risk of failure, to uncover the sources of their learning difficulties and to plan for an appropriate supplemental intervention or remediation". The underlying scope is to customise teaching, always aiming at improving learning outcomes and student performance.

The goal of diagnostic assessment is to actually get a picture of where students currently stand intellectually, allowing teachers to make sound instructional choices and adaptations as to how to teach the new course content and what teaching approach to use. These assessments can be designed by teachers, embedded within the curriculum, or may be off-the-shelf taken from existing stock of diagnostic tests such as short quizzes, multiple choice tests, etc. An identical type of assessment as post-assessment may be given

post-instruction to identify whether students have met a course's required learning objectives.

Interim tests, which are administered periodically during a course or throughout the school year, provide valid, reliable results, data and information being used to regulate to what extent teachers should customise their teaching practices to make learning more effective. The main characteristic of interim tests is the time of the year they are given, their length and their duration. The number of interim assessments given to students basically depends on the state with teachers having the possibility, however, to administer interim assessment as often as they consider it appropriate. The most important idea is that valuable information about students' knowledge is received in a quick, simple manner.

Herman (2017) supports that interim tests "evaluate students' knowledge and skills relative to a specific set of academic goals, typically within a limited time frame". The students' learning progress is put under the microscope providing documentation about their academic readiness, checking at the same time students' grasp of course content in order to guide future instruction. According to scholars, the purpose of administering interim assessments is definitely "instruction and curriculum planning, evaluation (e.g., of various programs or instructional approaches), and prediction of end of year proficiency in order to identify and take action on students at risk of failure", though the counterargument claims that "available evidence does not document a strong positive effect on student achievement" (ibid).

Ranging from a combination of teacher-designed short-form tests to longer-form assessments, in-class writing exercises, and various kinds of group work in the class, they are definitely designed according to curricula aims and goals. It is worth mentioning that teachers may as well use interim assessments to identify concepts related to course content that students are struggling to understand, skills they are having difficulty mastering, or learning standards they have not yet achieved according to the curriculum so that adjustments and modifications can be made to lessons, instructional techniques, and academic support in general. Schools should mediate the test results to parents so that they get to know their children progress at school. This interaction on behalf of teachers sharing these data with families can provide additional learning support.

ii. Formative Assessment

The development of the concept of formative assessment in the learning environment took place gradually ending up to be defined as a process providing "information about the learning process that teachers can use for instructional decisions and students can use in improving their performance, which motivates students" (Wiliam 2011). This implies that it should be a frequent, interactive assessment of students' progress leading to understanding and identifying learning needs in order to adjust teaching appropriately with learners actually getting involved in this process. Pedder & James (2011) support that "when teachers and students use assessment information for supporting improvements in learning, they are

fulfilling the educational purposes of assessment" adding that the classroom strategies teachers and students develop and use to support learning may as well be referred as assessment for learning.

This type of assessment requires "evaluation of student learning outcomes several times during a semester and facilitates the evaluation of different content areas, skills, and the progress of learning within specific knowledge domains" (Perera-Diltz, 2014). As a result, assessment seems to be an on-going process taking place in every classroom activity involving learners in all aspects of their learning process. Formative assessment can be used as an effective tool in helping individual students maintain progress toward meeting performance standards. With reference to the same issue, Stiggins & Chapuis (2006) assert that "research has shown that consistently applying principles of assessment for learning has yielded remarkable, if not unprecedented, gains in student achievement … allowing learners to build their confidence and maximise their achievement". The same scholars point out that the aforementioned goals and benefits can be accomplished as long as the expected requirements are fulfilled during assessment practices:

1. Clear purposes: Assessment processes and results serve clear and appropriate purposes.

2. Clear targets: Assessments reflect clear and valued student learning targets.

3. Sound design: Learning targets are translated into assessments that yield accurate results.

4. Effective communication: Assessment results are managed well and communicated effectively.

5. Student involvement: Students are involved in their own assessment.

Thus, as the school year progresses, formative assessments help teachers deeply understand their students' needs and accomplishments continuously updating relevant data and information. It should be noted that lately there is a shift of emphasis with reference to the attitude towards student assessment since there is a changing perspective adopting a learner-centred approach, which strongly contributes to the improvement of learning. The latter indicates a growing interest between classroom learning and assessment leaving behind forms of assessment which put restrictions on facilitating students' achievement of academic success.

Among the characteristic examples of formative assessment are classified the in-class discussions, drawing a concept map in class to represent students' understanding of a topic, impromptu quizzes, lesson exit tickets to summarise what students have learnt, informal classroom observation, and worksheets. The ultimate aim is to have data regarding recently taught material that should align with unit or module learning outcomes and objectives.

For an assessment to be formative, it requires feedback which indicates the existence of a 'gap' between the actual level of the work being assessed and the required standard (Taras,

2005). Gikandi et al. (2011) argue that "feedback is most effective when highly related to clearly identified learning goals so that effective formative feedback is not only based on monitoring progress toward the specific goals but also promotes students to develop effective learning strategies". It becomes obvious, then, that there is a link between learning goals and learning strategies, which can be fostered by providing constructive feedback. Therefore, only under these conditions can it be said that assessment is a formative process aimed at supporting learning.

Nonetheless, the last three decades there has been an increasing interest in finding alternatives to traditional forms of assessment and educators, teachers, and curriculum developers have been trying to identify appropriate procedures to assess the knowledge, skills and abilities of students. In the field of education the need for alternatives to the established types of assessment has emerged raising the issue of finding new meaningful methods of assessment. These new processes should still integrate teaching, learning and assessment into a whole assessing learner achievement and performance using tasks and classroom activities that represent curriculum goals and up-to-date instruction practices. Thus, the traditional forms of assessment gave way to "alternative" ones as "the multiple forms of assessment that reflect student learning, achievement, motivation, and attitudes on instructionally-relevant classroom activities" (O'Malley & Valdez Pierce, 1996) has always been a challenge.

d. Why alternative assessment?

The types of assessment examined so far have been a valuable tool and the mainstream in education for centuries serving a variety of purposes, such as being a useful source of gathering information about students' knowledge, reinforcing teaching and learning, facilitating curriculum reform, etc. However, there has been a rising concern about their contribution to testing overall student achievements, skills, attitudes, motivation predispositions as well as including other learning outcomes. As a result, there has been a shift of emphasis towards alternative methods of assessment because of dissatisfaction with types of information gathered, with teacher-made tests, with high-stakes/standardised tests (Tsagari & West, 2004).

Alderson & Banerjee (2001) define alternative assessment as "usually taken to mean assessment procedures which are less formal than traditional testing, which are gathered over a period of time rather than being taken at one point in time, which are usually formative rather than summative in function, are often low-stakes in terms of consequences, and are claimed to have beneficial washback effects".

Tsagari & West (2004) provide a detailed list with reference to the most commonly used methods of alternative assessment according to scholars as follows: self-assessment, peer-assessment, portfolios, projects, debates, diaries, journals, logs, story retelling, etc.

The most often used types of alternative assessment are portfolios, self-assessment and peer-assessment.

With reference to the theoretical framework for using alternative assessment in the classroom, Janisch et al. (2007) claim that it "includes considering learners as constructors of knowledge; finding authenticity in materials and activities; employing dynamic, ongoing evaluation tools; and empowering students". These seem to be beneficial for learners allowing them to draw on skills such as creativity, written communication, critical thinking, public speaking, etc. Furthermore, alternative assessment facilitates students to demonstrate what they have learned in their own personalised manner utilising their personal strengths and engaging their interests, thus, ultimately being motivated. This produces meaningful results both for teachers and learners providing useful information easy to understand going a step beyond test scores and grades.

e. What is Self-Assessment?

Brown & Harris (2013) define self-assessment as "a descriptive and evaluative act carried out by the student concerning his or her own work and academic abilities" whereas as Panadero et al. (2016a) put it, it comprises a "wide variety of mechanisms and techniques through which students describe (i.e., assess) and possibly assign merit or worth to (i.e., evaluate) the qualities of their own learning processes and products". Andrade (2019) comments, however, that what is missing from the aforementioned definitions is the reason why we ask students to get involved in self-assessment supporting the view that self-assessment has to do with providing feedback. Feedback is needed in order to make "adjustments to processes and products that deepen learning and enhance performance; hence the purpose of self-assessment is to generate feedback that promotes learning and improvements in performance. This learning-oriented purpose of self-assessment implies that it should be formative: if there is no opportunity for adjustment and correction, self-assessment is almost pointless".

Consequently, students get involved actively in their own learning rather than "become passive recipients of knowledge" that entails "the students' engagement in active reflection of their own performance with a view of improving it" (Anastasiadou, 2013). This means that learners are able to make judgments about their own work. So, learners will get involved in a process of forming a clear opinion about their learning process based on careful thought, thus, acquiring relevant and appropriate individualised strategies to master learning. Cameron (2004) claims that students who learn to assess their own work move "from being "other-regulated" to being "self-regulated" or autonomous". As a result, they become able to monitor their own performance, evaluate their progress, control their learning and decide how to use the resources available to them within or outside the classroom (O'Malley & Valdez-Pierce, 1996).

However, self-assessment was also met with considerable scepticism, largely due to concerns about the ability of learners to provide accurate judgments of their achievement and proficiency. Gardner (2000) asserts that great benefits can be derived from self-assessment, although "it is a technique that needs to be introduced carefully and accompanied by considerable awareness raising and support". A series of self-assessments will provide learners with the skill to take responsibility for monitoring their progress making them autonomous. On the other hand, a possible pitfall would be the issue of reliability as well as the change in roles of both learners and teachers by introducing self-assessment (ibid).

f. What is Peer-Assessment?

Peer-assessment is an alternative form of learner assessment, which profoundly changes the role of assessment itself. Wen & Tsai (2006) argue that peer-assessment is found "to increase student–student and student–teacher interactions, and can be used to enhance learner's understanding about other students' ideas during the learning experience". They also pinpoint that "using the Internet in aid of peer-assessment can improve the freedom of time and space for learners" adding that the implementation of computerised or online peer-assessment activities can speed up grading time along with providing more meaningful feedback (ibid).

Peer assessment involves students in assessing the work of their peers against set assessment criteria. Therefore, learners are engaged in providing feedback to their peers for tasks and activities related to teaching content. At this point, it is worth presenting Sluijsmans et al. (1998) view, who support that peer and self assessment can be presented as a continuum whereas "at one end of the spectrum, it could involve them giving feedback of a qualitative nature or, at the other, it might involve them in marking". This way assessment acquires both formative and summative traits forming part of "a larger scheme in which peer feedback is given prior to self-assessment" by the learners themselves. Peer- and self-assessment, then, may be considered as an amalgamation, so to speak.

Among the benefits of peer-assessment mentioned by scholars, apart from the fact that students learn to develop high levels of responsibility focusing on the learning process itself, building up their understanding, it engages learners in judgement-making, in addition to providing "the learners a context where they can observe the role of their teachers and understand the nature of assessment" (Hanrahan & Issacs 2001 in Wen & Tsai, 2006). The latter can result in the creation of empathy, this inner feeling that makes people able to project one's own inner strivings, movements, and feelings and perspectives, to step into the shoes of another person, hence strengthening collaborative aspects of classroom interaction.

For this reason, peer-assessment may be used as a powerful way for students, who act as assessors, thus having the possibility to better understand assessment criteria.

Consequently, they gain an insight into them, thereby, potentially increasing their motivation and engagement. This makes peer assessment an important component of [alternative](#) assessment aiding students to develop judgement skills, critiquing abilities and self-awareness.

g. The What and Why of a Portfolio

Paulson et al. (1991) state that a portfolio is "a purposeful collection of student work that exhibits the student's efforts, progress and achievements in one or more areas" adding that this collection "must include student participation in selection contents, the criteria for selection, the criteria for judging merit, and evidence of self-reflection". It follows, hence, that a portfolio may represent a powerful tool able to encourage students to take charge of their own learning, critically assemble parts of their own work making assessment an authentic process. Consequently, portfolios become "an intersection of instruction and assessment: they are not just instruction or just assessment but, rather, both" (ibid). Therefore, the two of them together constitute a sum adding value to the teaching and learning process bridging them into a whole. Portfolios give teachers the opportunity to assess student development over periods of time, sometimes across several years.

Portfolios may have two distinct functions in the learning and assessment process (O'Malley & Valdez Pierce 1996; Council of Europe, 2001a). The pedagogic function of a portfolio should be stressed as it may force students to become self-organised, reflecting on their own learning experiences. Portfolios constitute a medium for continuous assessment and a tool for documenting students' authentic samples of their performance, ability, progress. In fact, they are used to underline and represent the authenticity of assessment and students' critical thinking skills. (Zhu, 1997, Hamayan, 1995). Undoubtedly, the selection of its content should fit into learning goals and objectives (Boyle, 1994) serving a practical factor as well. Interestingly, a portfolio proves to be highly interactive as it encourages and develops collaborative relationships between student-student and teacher-student (Boyle, 1994).

Secondly, the function of a portfolio as a reporting tool should also be mentioned as long as documenting students' learning outcomes may prove absolutely useful in the case of a number of stakeholders, i.e. teachers, academic institutions, parents, administrators, etc. Portfolios can be regarded as constantly transforming assessment tools taking into consideration both the products of learning providing evidence of the learning process at the same time. Nowadays, a portfolio is not just a folder of student work; it is a purposeful and thoughtful specific collection of students' accomplishments over time.

This effort of continuously enriching one's portfolio has created the necessity of using technology and software tools, which can organise content providing multimedia display. Abrami & Barrett (2005) support that electronic portfolios are personal learning management tools, which are "meant to encourage individual improvement, personal growth and development, and a commitment to life-long learning". Furthermore, Challis (2005) provides

an in-depth definition of e-portfolio as "selective and structured collections of information that are gathered for precise reasons of showing or evidencing one's accomplishments and growth by storing the evidences digitally and managing them using appropriate software that operates within a web environment".

Therefore, it can be argued that e-portfolios still continue to offer the possibility of assessment in the school context comprising authentic assessment and the evaluation of prior learning as they may scaffold attempts at knowledge construction (ibid). Accordingly, this gradual digitalised purposeful collection of students' work, which can store visual and auditory content including essays, projects, presentations, images, videos, etc. over time, can support a pedagogical framework for its implementation. Shortly, the portfolio is a challenging type of alternative assessment which encourages flexibility. The most important aspect of portfolios is its contribution in making students reflective, as it shows what the portfolio owner has learned through the course of studying, by justifying the reason for the included items within the portfolio.

On a final note, the idea that assessment can support teaching and learning cannot be doubted. Assessment, which aims to determine student learning outcomes, is by now an integral part of both traditional face-to-face and online education. Advances in technology have largely contributed to assessing students online, imposing the same principles as all other forms of assessment such as validity and reliability. Implementing, however, online assessment constitutes a challenge, requiring that the teacher create an interactive environment that enables learning and, at the same time, dedication and commitment on behalf of the student.

"Assessments may serve one or more of a number of purposes, such as confidence building, demonstrating learning gain, or motivation, and they may be constructed in a number of ways, for example, by the teacher, by the learner, collaboratively or as a portfolio (Gardner, 2000), no matter the learning environment assessment is administered, be it in traditional face-to-face classrooms or distance learning.

The process of assessment is a complex and demanding one since at the classroom level, "teachers must decide which specific knowledge, skills, attitudes, and beliefs warrant assessment; at what point and for what specific purpose they should be assessed; and which tools might best accomplish these classroom-based assessments." (Capraro et al., 2012).

Good assessment practices should include both formative and summative assessments and should be applied in concert. Harlen (2005) claims that "the synergy of formative and summative assessment comes from making use of the same evidence for the two purposes". It is worth noting, however, that as Wiliam (2011) eloquently clarifies "the distinctions between assessment for learning and assessment of learning on the one hand, and between formative and summative assessment on the other, are different in kind. The

former distinction relates to the purpose for which the assessment is carried out, while the second relates to the function it actually serves".

Thus, regarding academic assessments each state educational system should comprise a well-organised and thinking-out-of-the-box combination of formative, interim, and year-end summative tests providing a clear rationale and principles for teachers, educators, families, and policymakers. Moreover, a useful and reliable set of academic assessments must be followed by various data of student performance along with good practices indicating how they can be used to support students' academic achievements.

In particular, e-assessment technology gives teachers the opportunity to create appropriate innovative tools able to improve student engagement and performance, offer possibilities to practise competencies and skills, provide personalised feedback and, finally, improve student motivation. As Black & William (1998) point out "several studies show firm evidence that innovations designed to strengthen the frequent feedback that students receive about their learning yield substantial learning gains". Amongst the advantages of online assessment can be identified less paperwork, instant feedback about learner's progress, instant monitoring of student's performance having a positive effect on students' overall performance and learning experience.

While alternative assessment tools may take a variety of forms, they essentially privilege the students' own conceptualisation of their learning experiences. Alternative types of assessments are used to substitute standardised tests and exams providing a true assessment of what the student has learned. They support learners in going beyond acquired knowledge to focus on what they have actually learned by applying this knowledge. The ultimate goal of applying alternative assessment for teachers is to adopt a learner-centred attitude towards assessment, and how it can be implemented in everyday classroom practices.

Conclusion

The proposed pilot implementation of the CONNECT project is part of the response to lessons learned from the COVID-19 pandemic when many pre-existing inequalities were exacerbated and brought to the fore. Our proposition outlines a way forward for flipped classroom environments and tools in secondary education that can help build more resilient education and training systems preparing the ground to deliver high quality digital education always in line with the CONNECT project. The aim is to increase the inclusiveness and quality of education and improve the broad competence development of all learners. Secondary education preparedness can be supported developing an approach to flipped learning thus addressing the consequences of the pandemic on learners and educators. Moreover, we can build on teaching experience and successful innovations introduced or put under the microscope during the pandemic applying good practices of digital technology use which can prove useful to tackle the situation in the post-Covid era. In case of classroom activities suspension, the flipped classroom offers a solution that can be easily implemented and slightly modified accordingly. Students thus maintain active contact with the learning process, with their teachers and classmates and are encouraged to continue and utilize their skills through constructive processes.

The pilot implementation of the project itself does not claim for a mainstreaming of reduced teacher presence for learning to occur, nor does it encourage students spending more hours in front of a screen. A proliferation of platforms and communication channels can increase the risk of digital fatigue and burnout for students, teachers and parents (European Commission, 2021). Rather, as part of the recovery from the COVID-19 pandemic, the proposed implementation aims at supporting the continuous evolution and improvement of a well-balanced school education that promotes high quality and inclusiveness with the additional benefit of being sufficiently resilient to cope with and adapt.

Undoubtedly, the COVID-19 pandemic has had a significant impact on online education at European level. It was an opportunity to highlight the challenges and potential of educational systems. Distance education proved to be a wonderful source of enrichment of teaching practices that paved the way for school improvement. During the suspension of the operation of school units, teachers familiarised themselves in the use of digital tools for distance education. Shortly, teachers taking initiative themselves strengthened their digital skills, adopted new innovative approaches, and enriched their teaching practices by offering the valuable good of education to their students. At the same time students did not suffer by being deprived of learning opportunities.

As the COVID-19 infection gradually recedes and the health crisis looms on the horizon, countries consider graded and gradual re-opening of schools and face-to-face teaching and learning. The valuable experience gained from the organisation and operation of distance

education during the pandemic is an active legacy for the future. The knowledge and experience teachers have gained is an added value that can enhance their teaching practices in the post-COVID-19 era. The flipped classroom model will be a realistic and sustainable solution for future education adopting a suitable pedagogy to manage the transformation from conventional to distance education.

For the effective implementation of the CONNECT project efforts have been made to explore ways to develop a flipped classroom approach in secondary education for the benefit of all learners and ensure a lasting positive impact on teaching and learning which is, after all, of major importance. The aforementioned is an overarching objective adapted to students' age of the third grade of low secondary schools and the expected learning objectives according to curricula. This process included reinforcing the development of combining school site and distance learning environments in order to create more flexible and appropriate conditions for where learning takes place, taking into account the different needs arising from learners' different socio-economic conditions. An additional aim has been to foster the development and embedding of tools for learning in order to provide opportunities for investigation and expression while always focusing on Mathematics, Physics and Foreign Languages. Ultimately, supporting learning across different environments in addition to creating an appropriate balance between teachers and student-centered learning on the one hand, and collaborative and independent learning on the other has provided for new attractive opportunities and high-impact learning solutions for both learners and teachers.

In case classroom teaching is suspended again due to health conditions deterioration, live teaching will be replaced as a matter of course by distance education with chat rooms, teleconference or video conferencing etc. Under this difficult situation in order to swiftly respond to the COVID-19 pandemic, schools will have to adapt instruction to online teaching by using a variety of synchronous and asynchronous digital technologies and instructional approaches in order to facilitate students' learning, assess learning, and communicate with students and parents remotely. Blended learning including synchronous and asynchronous methods is considered an optimum choice in order to support online student learning addressing education challenges at the same time. Furthermore, integrating a blended learning approach can as well contribute to improving learners' resilience, to better coping with and adapting to changing circumstances in the post-COVID-19 world.

In the Erasmus+ CONNECT project, emphasis has been given to applying Differentiated Instruction acknowledging and adjusting all aspects, i.e. content, processes, product of either face-to-face classroom or distance learning activities in order to resonate with diverse classrooms. In a differentiated classroom, commonalities are acknowledged and built upon, and student differences become important elements in the teaching and learning process. Student diversity, thus, highlights the necessity to adopt a set of proactive instructional strategies. Accordingly, the role of the teacher is redefined as a multifaceted professional who adopts a student-centred approach responsible for planning and organising learning

opportunities for every student in the classroom. Consequently, the teacher anticipates the differences in students' readiness, interests, and learning profiles and, as a result, creates different learning paths so that students have the opportunity to learn as much as they can as deeply as they can (Tomlinson, 1997). With reference to assessment, the Erasmus+ CONNECT project proposes the use of both summative and formative types of assessment including a number of alternative methods such as self-assessment, peer-assessment as well as the portfolio. In addition, too much emphasis is put on e-assessment via technology in case face-to-face live activities are suspended. E-assessment offers teachers the opportunity to use appropriate innovative tools able to improve student engagement and performance so that learners practise competencies and skills and above all teachers provide learners with personalised feedback in order to improve student motivation.

Eventually, the Erasmus+ CONNECT project aims at preparing secondary schools and teacher training systems in the current conditions of the COVID-19 crisis, supporting all students to reach proficiency in Mathematics, Physics and Foreign Languages as well as completing lower secondary education. Cooperation is encouraged between Partners by supporting their actions while fully respecting their responsibility for following Curricula and Syllabuses, the content of teaching and the organisation of the education system in each country with proper distance education platforms and digital tools.

Distance school education in combination with the rapid development of information and communication technologies can be considered as complementary to lifelong learning by utilising alternative models, such as blended learning, the flipped classroom, differentiated instruction, using summative as well as alternative types of assessment. In this case there is a growing emphasis on the key role of teachers who are called upon to ensure inclusive and equitable quality education and promote lifelong learning opportunities for all students. Hence, distance school education opens up new perspectives and possibilities as an option in education provided within the Partner countries education systems, which are worth exploring further.

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Annex 1: Online survey

Country

Demographics

Current Position

- teacher
- Principal /Deputy Principal
- Other (please specify)

Teacher Speciality/School Subject(s) taught

Years of Professional Experience

- < 5 years
- 6-10 years
- 11-20 years
- 21-30 years
- >31 years

Age

- < 30 years
- 31-40 years
- 41 -50 years
- 51-60
- > 61 years

Gender

- Female
- Male
- Prefer not to answer

Experience of lockdown periods in relation to the professional status

Place

- at home
- outside my home
- other (please specify)

Modality

- Only teleworking
- Partly teleworking
- No teleworking

People

- with members of my family
- alone
- with children
- without children
- other (please specify)

Feelings

FEELINGS	Not at all	A little	Somewhat	A lot
happy				
secure				
disoriented				
angry				
anxious				

Use of Devices

- Before lockdown periods
  - Desktop computer
  - Laptop computer
  - Digital tablet
  - Smartphone

- During lockdown periods
    - Desktop computer
    - Laptop computer
    - Digital tablet
    - Smartphone
- After lockdown periods
    - Desktop computer
    - Laptop computer
    - Digital tablet
    - Smartphone

Services & Tools

Before lockdown periods

SERVICES/TOOLS	Never	Sometimes	Often	Always
E-mail				
SMS				
Social media (Facebook/Messenger, Twiter, WhatsApp,				
Official Ministry of Education Digital Work Environments (local examples) ENT, E-class, E-me,...				
LMS (Moodle, Edmondo) (local examples)				
Virtual classes (Webconference or other like ZOOM, WEBEX, TEAM, ...)				
Digital textbooks approved by the Ministry of Education				
Other Digital Textbooks				
Video platforms (YouTube, Vimeo, ...)				

Repositories/Websites/Tools/ Apps approved by the Ministry of Education (…)				
Other Repositories/Websites/Tools Apps (LearningApps, Genial.ly, Edpuzzle, Padlet, Liveworksheets, Geogebra, Phet Colorado...)				
Website or personal blog				

- Other (please specify)

Choose three services/tools you will continue to apply

- After lockdown periods

Choose three services/tools you will continue to apply

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Teaching/Learning Activities

- **Before lockdown periods**

Teaching/Learning Activities	Never	Sometimes	Often	Always
Assigning homework				
Communicating with				

students (support, messages, comments, feedback, etc)				
Sharing teaching material and resources				
Sharing lessons with other colleagues				
Holding meetings and/or conferences with colleagues				
Holding meetings and/or conferences with stakeholders				

- Other (please specify)

After lockdown periods

Teaching/Learning Activities	Never	Sometimes	Often	Always
Assigning homework				
Communicating with students (support, messages, comments, feedback, etc)				
Sharing teaching material and resources				
Sharing lessons with other colleagues				
Holding meetings and/or conferences with colleagues				
Holding meetings and/or conferences with stakeholders				

- Other (please specify)

Methodological Approaches

Before lockdown periods

- Collaborative learning practices
- Flipped classroom approach
- Blended Learning
- Differentiated Approaches
- Multidisciplinary Approach (STEAM, CLIL, etc)
- Project-based learning
- Other (please specify)

During lockdown periods

- Collaborative learning practices
- Flipped classroom approach
- Blended Learning
- Differentiated Approaches
- Multidisciplinary Approach (STEAM, CLIL, etc)
- Project-based learning
- Other (please specify)

After lockdown periods

Choose three methodological approaches you will continue to apply

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Online teaching and pedagogical continuity

During lockdown, with whom have you exchanged to be able to work remotely ?

- With the students
- With the teachers from my school / with my colleagues
- With the teachers from other schools
- With the direction staff or educational advisers of my school
- With the direction staff of other schools
- With the academy (academic advisors, instructors, school inspectors, digital advisors, etc.)
- With external partners

According to you which were the main obstacles to ensure the school-family pedagogical continuity?

- Lack of digital devices of families
- Risk to increase the digital division
- Cultural or social distance between students and School
- Difficulties in designing very explicit distance courses
- Difficulties in cooperating with families
- Increase of students' school work in complete autonomy
- Educational work is more difficult to manage from distance
- School is seen as the only place to learn
- Education in general is not seen as sufficiently open and accessible
- Other

Challenges of online teaching/learning

The main challenge(s) of online teaching is/are

- the model of classroom approaches
- assessment reliability
- covering the whole school curricula
- managing teaching/learning time
- inequalities among students (e.g. internet access, use of tools, etc.)
- parents' role
- collaboration with colleagues
- professional inequalities (e.g. internet access, use of tools, etc.)

- Other (please specify)

Benefits of online teaching/learning

The main benefit(s) of online teaching is/are

- Having more flexibility in the management of resources and activities
- Maintaining socio-psychological links with students remotely
- Supporting the learning process for each student
- Developing the autonomy of students
- Re-enforcing school-family relation
- Developing 21st century skills (creativity, collaboration, etc.)
- Other (please specify)

Annex 2: Interview framework

1.   During the lockdown, has your role with the teaching staff changed?
   - Yes
   - No

Please specify your answer.

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2.   What were the obstacles while motivating/activating and coordinating the educational teams?

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3.   A. What were the main difficulties encountered by the students?

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        B. What were the main difficulties encountered by the teachers?

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4.   In addressing the above challenges, what solutions and/or innovative practices have been implemented?
   - Yes
   - No

Please specify your answer.

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5.   A. In your opinion, did the teaching staff have the necessary technical skills to deliver online courses?

- Yes
- Partially
- No

Please specify your answer.

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6.   What were the digital tools used to ensure communication with the parents of your students?

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7.   Have you secured the necessary resources and/or tools from the Ministry of Education and Culture to continue to follow appropriate pedagogical methods? Were they satisfactory? Why?

- Yes and it was satisfactory
- Yes, but it was not sufficient
- No

Please specify your answer.

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8.   Which digital tools were used most often in your school before and during the period of COVID?

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9.   Who were the educational institutions (helpdesk, IT teachers, technical support team, etc.) that you often contacted? How often? Which means did you use?

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10.   Can you mention any software and/or applications you have "discovered" that you find useful?

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11.   Do you get some positive elements from this period? If yes, which ones?

- No
- Yes

If yes, please specify your answer:

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12.   Following this period, do you think you will change some ways of practising your job? If yes, which ones?

- No
- Yes

If yes, please specify your answer :

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Annex 3: Panorama of Digital Tools

DIGITAL EDUCATIONAL RESOURCE (RNE)		FUNCTIONAL CHARACTERISTICS		
Name	**Internet link**	**Main function (brief explanation)**	**Access mode**	**COST**
Moodle	https://moodle.org/?lang=fr	Pedagogical sequence design (Learning Management System)	online with authentication	Fr
Digital textbooks	websites of the main publishing houses https://www.kiosque-edu.com/ https://www.lelivrescolaire.fr/ https://www.edulib.fr/ https://www.cns-edu.com/	Textbook with multimedia resources	Resource Access Manager of the ENT (schools' network of Digital Work Environments)	Pa
BRNE	https://eduscol.education.fr/228/brne	Digital resource bank to promote learning in several subjects, from primary school to the end of secondary school	Resource Access Manager of the ENT (schools' network of	Fr

			Digital Work Environments)	
Eduthèque	https://www.edutheque.fr/accueil.html	Ressources pédagogiques, culturelles et scientifiques en provenance d'instituts	online with authentification	Fr
Jules	https://jules.cned.fr/JulesV2/?page=0	Agent conversationnel (chatbot) capable de répondre aux questions des élèves pour les aider à faire leurs devoirs.	online with authentification	Fr
D'COL	https://www.dcol.fr/Identification/login.aspx?ReturnUrl=%2f	Accompagnement en classe, hors des cours, et à la maison pour des groupes d'élèves ciblés (soutien scolaire)	Resource Access Manager of the ENT (schools' network of Digital Work Environments)	Fr
ETINCEL	https://www.reseau-canope.fr/notice/etincel.html	Favoriser l'émergence d'une culture scientifique, technique et industrielle.	online with authentification	Fr
Pix	https://pix.fr/	Exercices pour développer, évaluer et certifier ses compétences numériques	Resource Access Manager of the ENT (schools'	Fr

			network of Digital Work Environments)	
Qioz	https://qioz.fr/fr	Apprendre les langues avec des films, séries et documentaires	Resource Access Manager of the ENT (schools' network of Digital Work Environments)	Fr
Pearltrees	https://www.pearltrees.com/	Organisation de contenus pour l'enseignement	Resource Access Manager of the ENT (schools' network of Digital Work Environments)	Pa
Edumalin	https://www.edumalin.fr/home	Assistant virtuel pour expliciter la méthode de travail, guider, réguler et corriger le travail des élèves lors de leurs devoirs en autonomie	Resource Access Manager of the ENT (schools' network of Digital Work Environme	Pa

			nts)	
Mindview	https://www.matchware.com/fr/logiciel-de-mind-mapping	logiciel de mind mapping et gestionnaire de projet	online with authentification	Pa
Labomep	https://labomep.sesamath.net/	Proposer aux élèves des exercices d'apprentissage, d'entraînement et d'en suivre les résultats	Resource Access Manager of the ENT (schools' network of Digital Work Environments)	Pa
EducArte	https://www.arte.tv/sites/fr/corporate/enseignants-et-eleves/	Accès aux vidéos de la chaîne ARTE avec un outil de personalisation pédagogique	Resource Access Manager of the ENT (schools' network of Digital Work Environments)	Pa
Projet Voltaire	https://www.projet-voltaire.fr/	Remise à niveau en orthographe et en expression écrite	Resource Access Manager of the ENT (schools' network of Digital Work	Pa

			Environments)	
Edumédia	https://www.edumedia-sciences.com/fr/	Animations, vidéos et quiz pour illustrer les notions de cours de scinces	Resource Access Manager of the ENT (schools' network of Digital Work Environments)	Pa
Kwyk	https://www.kwyk.fr/	Créer des devoirs de maths à partir d'exercices autocorrigés avec un suivi personnalisé	online with authentification	Pa
Adaptiv'Langue	https://www.evidenceb.com/	Parcours d'apprentissage ou de remédiation adaptatifs pour la maîtrise de la langue française	Resource Access Manager of the ENT (schools' network of Digital Work Environments)	Pa
Ma Classe à la maison (CNED)	https://www.cned.fr/ma-classe-a-la-maison	Outil de visioconférence pour la classe virtuelle	online with authentification	Fr

Anki	https://apps.ankiweb.net/	Permet de mémoriser et de réviser suivant le principe de la répétition espacée	online with authentification	Fr
Padlet	https://fr.padlet.com/	Partage de notes sous forme de post-it sur un tableau collaboratif	online with authentification	Fr and Pa
Wekan	https://wekan.github.io/	Gestionnaire de tâches collaboratif en ligne pour les projets pédagogiques.	online with authentification	Fr
Digital Work Environment timeline	https://ent.parisclassenumerique.fr/timelinegenerator https://ent.iledefrance.fr/timelinegenerator	Outil de représentation des événements sous la forme d'une frise temporelle	Resource Access Manager of the ENT (schools' network of Digital Work Environments)	Fr
Digital Work Environment exercise maker	https://ent.parisclassenumerique.fr/exercizer	Outil pour créer des exercices, les distribuer avec une possible correction automatique.	Resource Access Manager of the ENT (schools' network of Digital Work Environments)	Fr

Digital Work Environment mindmap	https://ent.parisclassenumerique.fr/mindmap# https://ent.iledefrance.fr/mindmap#	Outil pour représenter visuellement une arborescence d'idées	Resource Access Manager of the ENT (schools' network of Digital Work Environments)	Fr
Digital Work Environment Multimedia notebook	https://ent.parisclassenumerique.fr/scrapbook https://ent.iledefrance.fr/scrapbook	Création et partage de cahiers multimédia avec des illustrations sous formes vidéos, sons et textes	Resource Access Manager of the ENT (schools' network of Digital Work Environments)	Fr
Digital Work Environment webconference app	https://ent.parisclassenumerique.fr/webconference https://ent.iledefrance.fr/webconference	Création et partage des salles de visioconférences	Resource Access Manager of the ENT (schools' network of Digital Work Environments)	Fr

Digital Work Environment blog	https://ent.parisclassenumerique.fr/blog https://ent.iledefrance.fr/blog	Outil de publication d'informations et de contribution des autres utilisateurs	Resource Access Manager of the ENT (schools' network of Digital Work Environments)	Fr
Digital Work Environment email service	https://ent.parisclassenumerique.fr/conversation/conversation https://ent.iledefrance.fr/zimbra/zimbra	Service de messagerie entre les utilisateur de l'ENT	Resource Access Manager of the ENT (schools' network of Digital Work Environments)	Fr
Digital Work Environment collaborative wall	https://ent.parisclassenumerique.fr/collaborativewall https://ent.iledefrance.fr/collaborativewall	Création des murs virtuels pour partager des idées sous forme de post-it	Resource Access Manager of the ENT (schools' network of Digital Work Environments)	Fr

Digital Work Environment collaborative writing tool	https://ent.parisclassenumerique.fr/collaborativeeditor	Editeur en ligne pour élaborer un texte à plusieurs auteurs.	Resource Access Manager of the ENT (schools' network of Digital Work Environments)	Fr
Quizinière	https://www.quiziniere.com/	Conception et distribution de QCM	online with authentification	Fr
Capytale	https://www.ac-paris.fr/portail/jcms/p1_1971804/capytale-un-service-web-pour-creer-et-partager-des-activites-pedagogiques-de-codage	Création et partage d'activités de codage entre enseignants et élèves	online with authentification	Fr
La physique à main levée	http://phymain.unisciel.fr/	vidéos d'expériences avec fiches pédagogiques	online without authentification	Fr
Mécachrono	https://www.boreale.org/?mecachrono	Application de pointage de vidéo pour l'étude des mouvements (positions, vitesses, accélération)	online without authentification	Fr
QCM Cam	https://qcmcam.net/	Application de sondage instantané (avec webcam ou smartphone)	online without authentification	Fr

Bac à proton	https://www.bacaproton.fr/	Conception de QCM adaptatifs pour l'entrainement autonome des élèves (avec éditeur d'équation)	online without authentification	Fr
Genially	https://www.genial.ly	Création de plans de travail et présentations intéractifs	online with authentification	Fr
La Digitale (DigiQuiz)	hhttps://ladigitale.dev/#outils	Création et lecture de contenus H5P en et hors ligne (autres applications)	online and offline without authentification	Fr
Ostralo	http://www.ostralo.net/	Banque de simulations et animations en HTML5, de cours et d'exercices interactifs	online without authentification	Fr
Cea	https://www.cea.fr/comprendre/enseignants/Pages/Accueil.aspx	animations interactives, vidéos, banques de ressources, quiz, jeux	online without authentification	Fr
Culture Sciences Physique	http://culturesciencesphysique.ens-lyon.fr/	banque de ressources scientifiques (articles, vidéos, simulations) à destination des enseignants	online without authentification	Fr
Culture Sciences Chimie	https://culturesciences.chimie.ens.fr/	banque de ressources scientifiques (articles, vidéos, simulations) à destination des enseignants	online without authentification	Fr

kesako	http://kezako.unisciel.fr/cest-quoi/	Capsules pédagogiques à destination des élèves	online without authentification	Fr
Phet Colorado	https://phet.colorado.edu/	Banque de simulations et exercices interactifs en HTML5	online without authentification	Fr
Maskott (disponible dans la BRNE)	https://monlycee.net/ ou https://www.parisclassenumerique.fr/	faire entraîner les élèves en sciences sur tous les points du programme avec des exercices variés et motivants	Resource Access Manager of the ENT (schools' network of Digital Work Environments)	Fr
Tinkercad by Autodesk	https://www.tinkercad.com/	Conception 3D, conception électronique et programmation de microprocesseur Arduino	online with authentification	Fr
Vittascience	https://fr.vittascience.com/	Pour apprendre à programmer les micro-contrôleurs microbits	online without authentification	Fr
Learning apps	https://learningapps.org/	excercices multimédia parfois autocorrectifs	online without authentification	Fr

Kahoot	https://kahoot.com/	excercices/jeux	online	Fr
Actualité+B55: U56	https://ent.parisclassenumerique.fr/actualites	Publier des informations, par thématique, en ciblant les destinataires	Resource Access Manager of the ENT (schools' network of Digital Work Environments)	Fr
Pages	https://ent.parisclassenumerique.fr/pages	Outil pour créer des pages web	Resource Access Manager of the ENT (schools' network of Digital Work Environments)	Fr
Dropbox	https://www.dropbox.com/	stockage de données	online with authentification	Fr
Next Cloud	https://nextcloud.com/	stockage de données	online with authentification	Fr

Slack	https://slack.com	outil collaboratif de messagerie	online with authentification	
Peertube	https://joinpeertube.org/en_US/	plateforme de stockage videos		
Schwobie	https://www.showbie.com	devoirs en ligne, discussion avec classe, portflio pour élèves, classe virtuelle	online with authentification	Fr
WeTransfer	https://wetransfer.com/		online without authentification	
Open Scan	https://play.google.com/store/apps/details?id=com.ethereal.openscan	application pour scanner sa copie en PDF		
Wondershare Filmora	https://filmora.wondershare.net	screenshot		
Openshot	https://www.openshot.org	logiciel libre de montage vidéo		

Big Blue Button	https://bigbluebutton.org/	videoconferences and chat		
Framapad	https://framapad.org/fr/	collaborative documents	online without authentification	Fr
Wordpress	https://wordpress.com	Is a free and open-source content management system, written in PHP and paired with a MySQL or MariaDB database often used for e.g. internet websites. It offers several plug ins that can operate as Learning Management System	online with authentification	Fr
Second Life	https://secondlife.com/	virtual world used in recent years by many educators. Second Life offers a new way to learn enabling esperential learning in a role-play game set in a 3D environment.	online with authentification	Fr

Milanote	https://milanote.com/	Online software allowing brainstorming the creative technique for solving problems or gathering ideas spontaneously. Milanote lets to run group brainstorming sessions wherever partecipants are located.	online with authentification	Fr
OpenSimulator	http://opensimulator.org	an open source multi-platform, multi-user 3D application server. OpenSimulator can be used to create a virtual environment which can be accessed through a variety of clients and allow to develope your world with your rule and your didactical methodologies.	online with authentification	Fr
Quizlet	https://quizlet.com/	a free interactive learning tool for teachers which allows to create learning cards and generate games from them. The tool has already a database of games on many different topics. It is free in basic version.	online with authentification	Fr

Edmodo	https://new.edmodo.com/	global educational network used by both, teachers and their students and possibly also student's parents. The site enables to create a virtual classroom where it is possible to better collaborate, team work, provide study materials, give home works and evaluate them. It can be used as a website or mobile App	online with authentifica tion	Fr
Zoom	https://zoom.us/	online video communication tool for video-conferencing free of charge; it only needs registration for the moderator/ facilitator but not the other participants and can be used without specific accounts to be created by all participants. Invitations to meetings, talks, chats can be shared via email and are hence simpler than some other similar tools (like skype, ezTalk)	online without authentifica tion	Fr
Axios	https://axiositalia.it/accesso -registro-elettronico/	Electronic class register and tools for the complete management of Workflow and for the implementation of dematerialization regulations inside the school	online with authentifica tion	

TedED	https://ed.ted.com/	A new feature friom TED community (TedEx/TedTalks) which intermediate education. It allows teacher to discover new ideas for lessons and create own lessons with features like added questions or topics for discussion. It also offer educational videos for students on topics like business or technology with real life examples which can spark the lessons or be used as homeworks to watch.	online with authentifica tion	Fr
OERCommon s	https://www.oercommons.or g/	Is a public digital library of open educational resources. You can explore, create, and collaborate with educators from around the world. Materials are organized by topic, subject type (course, module, lesson plan, etc.), media type, and intended users.	online without authentifica tion	Fr

Eclass	https://eclass.sch.gr	It's an electronic class, for asychronus teaching. Teacher invite students, students login via Greek School Network, and teachers upload content of lesson , exercises etc. and students styde the content, do the exrcises and send them to teachers, they can send messsages to each other.	online with authentification	Fr
Webex	https://webex.sch.gr	It's a sychronous teaching platform,it only needs registration for the teacher via Greek School Network, but not for students. Online video communication tool, invitation to meetings, talks, chat, share content.	online without authentification	Fr